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This is EPA Region 10's second annual summary report of environmental indicators for air, water, and land media. The Region's programs in air, water, toxics, pesticides, and hazardous waste are attempting to characterize their progress in addressing environmental pollution via the measures described in this report. The FY 88 report builds upon the FY 87 document by adding FY 88 data, refinements to FY 87 indicators, and several new measures.

Each program's chapter includes an introduction providing pertinent background information, and, for each environmental indicator: a narrative explaining how the indicator describes environmental quality or progress; a discussion of the indicator's limitations; a display of data in the form of tables/graphs/maps with accompanying interpretation; and plans for modification of present indicators and/or development of future ones.

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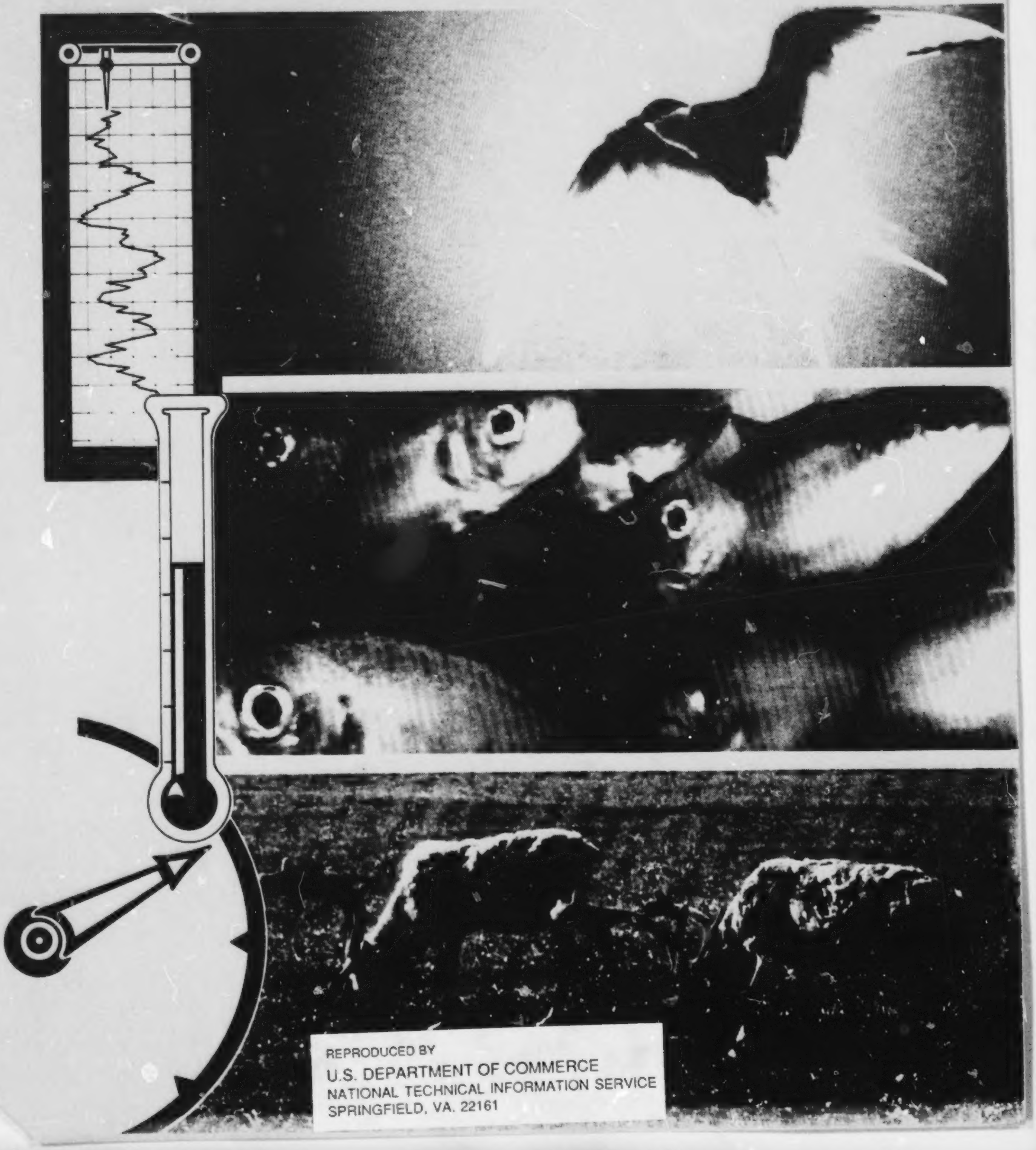
Region 10 Environmental Indicators
FY 88 Summary



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Foreword

It is my pleasure to present the second summary of Region 10 environmental indicators. Many of the measures presented in this summary have been modified since our first effort, and further changes are anticipated for FY 90. Regional staff continue to refine and explore ways to measure environmental quality and our progress in meeting environmental goals. As national measures are developed, they will be incorporated into our regional efforts.

The indicators in this report have been developed by using existing data, resulting in little or no cost to the Region. In many cases, information has been obtained from other agencies or by looking at the data we have in a different way. For new programs or initiatives, the Region is making a concerted effort to identify mechanisms for measuring environmental progress up front, continually asking ourselves, "How do we spell success?"

I would like to thank regional program managers and their staff for their diligent work and the Policy, Planning & Evaluation Branch for their continued leadership and coordination of this project.

Robie G. Russell
Regional Administrator

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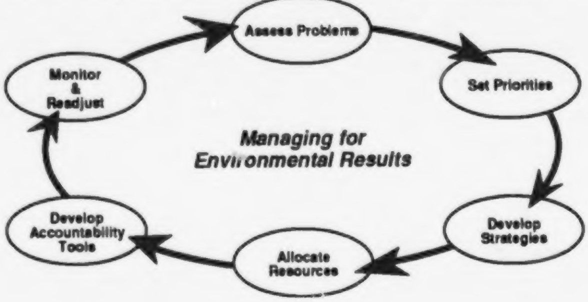
Development of Environmental Indicators in Region 10: An Update

Background

Since the mid 70's EPA managers have been asking themselves the question, *"As a result of our efforts,* ***is the environment getting cleaner?"*** Environmental indicators help managers to formulate an answer.

In the "Management for Environmental Results" process, environmental indicators function as a problem assessment tool (see Figure 1). They should be useful both for assessing current problems and for discerning new and emerging ones. However, since environmental research and monitoring are not integral components of all EPA programs--particularly at the regional level--these "tools" are not readily available to most program managers. Thus, to establish and use indicators requires commitment and effort beyond the realm of normal programmatic duties.

Figure 1:
The Managing for Environmental Results Process



To successfully develop and implement regional environmental indicators we learned that it was necessary to

1. **Assign the task to a strong coordinating office;**
2. **Allow program managers and staff ownership of the measures;**
3. **Begin with useful measures--not necessarily perfect ones;**
4. **Establish accountability for results**; and
5. **Ensure top management support and participation in the effort.**

These "lessons learned" have served us well, and have since been shared with Headquarters and other regions.

In FY 88 we published our first comprehensive environmental indicators report that summarized data gathered through FY 87. The second report builds upon the first by adding FY 88 data, refinements to FY 87 indicators, and several new measures. As before, each program presented the content of their summary in individual briefings for the Deputy Regional Administrator. These briefings allowed a thorough discussion of all measures and resulted in a number of outcomes, including continued approval of current indicators, further refinement of measures, commitments to prepare specific additional environmental indicators and exploration of new possibilities. Decisions resulting from the briefings were put into writing and signed by both the programs and the DRA. These commitments are summarized at the end of each chapter on the pages entitled "Environmental Indicators, FY 89 and Beyond".

Next Steps

As an added dimension, this year the programs began to explore the use of photographs to document environmental changes over time. We are hoping to expand this usage as several programs have committed to pursuing this, where possible, as a part of their indicator documentation.

Throughout FY 89 programs will continue to track and summarize their indicators and pursue agreed upon improvements and additions. In October of FY 89 a third summary will be prepared. We anticipate that this process will continue, sustained by its own merit and fortified by Headquarters' interest and advances in this area.

New Directions

We've begun the process of linking environmental indicators with another problem assessment tool--comparative risk assessment. These are complementary initiatives in the following respects:

(1) **Environmental indicators are often useful for assessing and comparing risks to human health and the environment**;

(2) **When applying either "tool", mutually significant data gaps become apparent**; and

(3) **Both contribute valuable insights useful to environmental managers, each from a different perspective.**

We intend to further develop and solidify these links in FY 90 and to ensure that comparative risk assessment and environmental indicators are effectively integrated into our planning and management processes.

Thus far, we have persevered with our intent to produce indicators which make use of existing data. However, we are attempting to address, through strategy proposals (generated through the comparative risk project), the data gaps which have surfaced.

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Approach

The framework used for developing environmental indicators is shown in Figure 2. We employed the concept that EPA and state programmatic activity affect polluter behavior; that polluter behavior in turn affects ambient pollution levels in the environment; and that ambient levels of pollution have an effect upon health and ecological integrity. Thus, we have encouraged programs to develop measures on more than one level (see Figure 3), realizing that the easiest to produce but most limited in scope are the activity measures, while the most desirable but often most difficult to acquire are those reflecting environmental quality.

Table 1 displays each program's FY 88 environmental indicators according to the hierarchy of preferred data; Table 2 lists those for FY 89 and beyond. Though "true" environmental indicators are the ideal measures, all levels of indicators, though surrogate in nature, are considered valuable, if not essential, to overall program management.

Figure 2
Developing Environmental Indicators
Managing for Environmental Results
Conceptual Framework

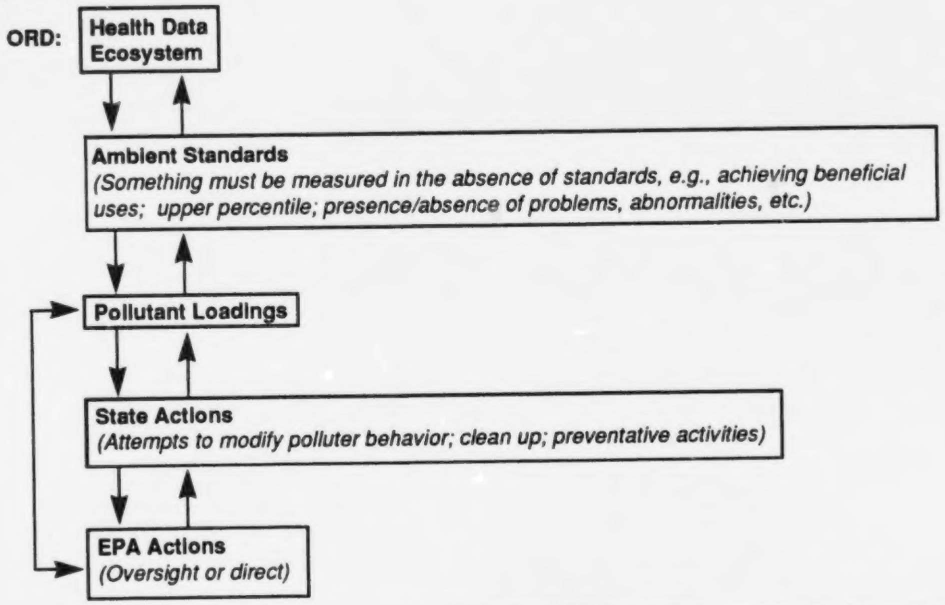
ORD:
Health Data
Ecosystem
Ambient Standards
(Something must be measured in the absence of standards, e.g., achieving beneficial uses; upper percentile; presence/absence of problems, abnormalities, etc.)
Pollutant Loadings
State Actions
(Attempts to modify polluter behavior; clean up; preventative activities)
EPA Actions
(Oversight or direct)

Figure 3
Levels of Environmental Data

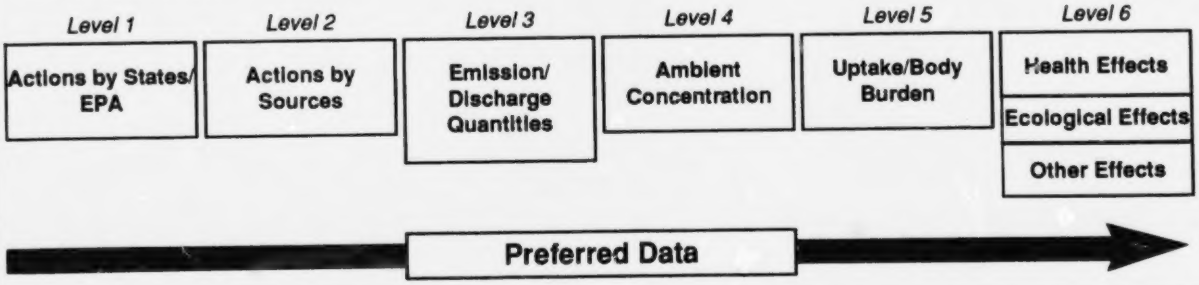
Level 1
Actions by States/EPA
Level 2
Actions by Sources
Level 3
Emission/Discharge Quantities
Level 4
Ambient Concentration
Level 5
Uptake/Body Burden
Level 6
Health Effects
Ecological Effects
Other Effects
Preferred Data

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Table 1

Environmental Indicators in Region 10
FY 88

Program	**Level 1** *Actions by States/EPA*	**Level 2** *Actions by Sources*	**Level 3** *Emission/ Discharge*	**Level 4** *Ambient Concentrations/ Quantities*	**Level 5** *Uptake/ Body Burden*	**Level 6** *Health Effects; Ecological Effects; Other Effects*
Water Division:						
Surface Water	NPDES: -# permits w/ biomonitoring -# WQ-based permits (vs. BAT permits) -# WQ-based permits w/ toxics limits	-Pollutant loadings to WQL segments	NPDES: -Total loading limits for toxics	-Track for problem water bodies: -Listing of waterbody status -Listing of WQL segments -Limiting parameters for WQL segments -Permits allowing discharges to WQL segments -WQL segments for which all WQ-based controls have been implemented -Aerial lakeshore analysis for N. ID lakes -Status of classified shellfish areas -Water Quality Index -**Basin Pilot Projects** Yakima River Basin: - # smolts produced - Temperature - Nutrient levels - Riparian vegetation - Toxics concentrations Tualatin River Basin: - DO levels - Nutrients/chlorophyll a		-Summary of waters fully, partially, or not supporting uses -PNW Rivers Study database -**Basin Pilot Projects** Chehalis River Basin/ Grays Harbor: -% ocean catch -Na-ATPase levels in smolting salmon -Coho smolt production -Coho escapement -Maps showing WQ trends
Puget Sound		Sediment, Water Column, Biological, Habitat, and Short-Term Toxics Control Indicators as shown below:	-NPDES contaminant loading	-Sediment chemistry -Dissolved oxygen -Turbidity -Nutrients -Chlorophyll -Pathogen indicators	-Chemicals in fish tissue -Chemicals in shellfish tissue -Bacteria in shellfish	-Sediment bioassays -Benthic community analyses -Fish disease -Shellfish abundance -Wetland/Habitat Quality & Quantity -Effluent & near-source ambient biomonitoring -Wetland mitigation success -Fish abundance

Table 1 (Continued)

Environmental Indicators in Region 10
FY 88

Program	Level 1 *Actions by States/EPA*	Level 2 *Actions by Sources*	Level 3 *Emission/ Discharge*	Level 4 *Ambient Concentrations/ Quantities*	Level 5 *Uptake/ Body Burden*	Level 6 *Health Effects; Ecological Effects; Other Effects*
Water Division: **Construction Grants**			-BOD & SS improvements @ completed projects initiating operation in FY88, w/ possible enhancements of 1) more historic data; 2) O&M results; 3) decreases in residual chlorine; 4) toxics removed 5) before & after monitoring cases			
Drinking Water	-# & % SNCs for which "return to compliance" action has been taken -# state & EPA enforcemt actions -% SNC addressed by enforcement action	-# PWS in SNC -% PWS in compliance w/ bacti & turbidity M/R & MCLs -# & % community systems w/ surface water sources which use filtration or equivalent -# & % of non-community systems w/ surface water sources which use filtration or equivalent			-# persons served by systems in SNC & % of total population served by PWS -# persons served by systems in full compliance & % of total population served by PWS	
Wetlands	-Acreage of wetland mitigated for -- types lost/gained -Staff time spent on major vs. minor wetland projects -% projects w/ substantive comments -# signif. envmtl. issues raised & # resolved -# enforcement actions & # resolved -# permits denied due to EPA comments	-Project types impacting wetlands	-Cu. yds. dredged material allowed in-water & upland in Columbia R. & Puget Sound	-Acres & types wetlands lost -Acres wetlands impacted -Acres wetlands protected by project modification, w/drawal or permit denial -Linear feet of shoreline impacted by state		

Table 1 (Continued)

Environmental Indicators in Region 10
FY 88

Program	**Level 1** *Actions by States/EPA*	**Level 2** *Actions by Sources*	**Level 3** *Emission/ Discharge*	**Level 4** *Ambient Concentrations/ Quantities*	**Level 5** *Uptake/ Body Burden*	**Level 6** *Health Effects; Ecological Effects; Other Effects*
Water Division:						
Ground Water	-LUST: # leaking tank cleanups initiated & controlled -Pesticides: # leachable active ingredients registered for use in WA, OR, ID vs. # registered nationally	-UST: # & % of corrosion-protected tanks in use -Haz. Waste (HW): Site characterization status		-DW: % DW & monitoring wells w/ nitrates above a level of concern -DW: # & % GW PWS in viol. of chemical MCLs or M/R -HW: # & % of HW sites w/ GW contamination above a health advisory or MCL	-DW: Population at risk from PWS in violation of MCLs or M/R -HW: Population at risk from HW contaminants approaching & in DW wells	
Air & Toxics Division:						
Air	-Air Toxics: Review state evaluation & control of point sources -Asbestos: track notifications, inspections & NOVs -SIPs: track rulemakings/SIP approvals by pollutant -Radon: track public education & results	-Enforcement: Track significant violators	-Criteria Pollutants: emission inventory data -Air Toxics: Track annual changes to baseline inventories for selected pollutants	-Criteria pollutants: ambient concentrations -Enf: Try to link enf action i.e., reduced emissions, w/ ambient concentrations -Radiation: compare baseline levels w/ future measuremts -Radiation: explore use of ERAMS		
Toxics		-PCBs: Compliance rates for inspections -PCBs: Equipment removed from service early due to settlement negotiations -Asbestos: amount in schools abated due to settlement agreements -Asbestos (AHERA): to be developed		-PCBs: in sediments	-PCBs: residues in fish & shellfish	
Pesticides		-Public complaint data from state enforcement logs		-Pesticides in drinking water (EPA's National Drinking Water Well Survey)	-Pesticides in biota (EPA's National Bioaccumulation Study)	

Table 1 (Continued)

Environmental Indicators in Region 10
FY 88

Program	**Level 1** *Actions by States/EPA*	**Level 2** *Actions by Sources*	**Level 3** *Emission/ Discharge*	**Level 4** *Ambient Concentrations/ Quantities*	**Level 5** *Uptake/ Body Burden*	**Level 6** *Health Effects; Ecological Effects; Other Effects*
Hazardous Waste Division:						
RCRA				-GW quality at RCRA regulated LDFs (Reg. Units & SWMUs) -Groundwater/Soils quality at RCRA regulated incineration, storage & treatment facilities (Reg. Units & SWMUs)		
Superfund	-Program accomplishments as per SCAP & SPMS measures			-GW cleanup (NPL sites) -Soils cleanup (NPL & non-NPL removal sites) -Surface materials cleanup (NPL & non-NPL removal sites)		

Table 2

Environmental Indicators in Region 10

FY 89 & Beyond

Program	**Level 1** *Actions by States/EPA*	**Level 2** *Actions by Sources*	**Level 3** *Emission/ Discharge*	**Level 4** *Ambient Concentrations/ Quantities*	**Level 5** *Uptake/ Body Burden*	**Level 6** *Health Effects; Ecological Effects; Other Effects*
Water Division:						
Surface Water	NPDES: -# permits w/ biomonitoring -# WQ-based permits (vs. BAT permits) -# WQ-based permits w/ toxics limits	-Pollutant loadings to WQL segments	NPDES: -Total loading limits for toxics -Discharges of residual chlorine	-Track for problem water bodies: -Listing of waterbody status -Listing of WQL segments -Limiting parameters for WQL segments -Permits allowing discharges to WQL segments -WQL segments for which all WQ-based controls have been implemented -Aerial lakeshore analysis for N. ID lakes -Status of classified shellfish areas -Water Quality Index -**Basin Pilot Projects** Yakima River Basin: - # smolts produced - Temperature - Nutrient levels - Riparian vegetation - Toxics concentrations Tualatin River Basin: - DO levels - Nutrients/chlorophyll a		-Summary of waters fully, partially, or not supporting uses -Photos of degradation/ improvement (opt.) -**Basin Pilot Projects** Chehalis River Basin/ Grays Harbor: -% ocean catch -Na-ATPase levels in smolting salmon -Coho smolt production -Coho escapement
Puget Sound		Sediment, Water Column, Biological, Habitat, and Short-Term Toxics Control Indicators as shown below:	-NPDES contaminant loading	-Sediment chemistry -Dissolved oxygen -Turbidity -Nutrients -Chlorophyll -Pathogen indicators	-Chemicals in fish tissue -Chemicals in shellfish tissue -Bacteria in shellfish	-Sediment bioassays -Benthic community analyses -Fish abundance -Shellfish abundance -Wetland/Habitat Quality & Quantity -Effluent & near-source ambient biomonitoring -Fish disease

Table 2 (Continued)

Environmental Indicators in Region 10
FY 89 & Beyond

Program	**Level 1** *Actions by States/EPA*	**Level 2** *Actions by Sources*	**Level 3** *Emission/ Discharge*	**Level 4** *Ambient Concentrations/ Quantities*	**Level 5** *Uptake/ Body Burden*	**Level 6** *Health Effects; Ecological Effects; Other Effects*
Water Division:						
Construction Grants			-BOD & SS improvements @ completed projects initiating operation in FY89 -O&M results -Amount sewage sludge shifted to beneficial use	-Before & after studies of receiving waters		
Drinking Water	-# & % SNCs for which "return to compliance" action has been taken -# state & EPA enforcemt actions -% SNC addressed by enforcemt action	-# PWS in SNC -% PWS in compliance w/ bacti & turbidity M/R & MCLs -# & % community systems w/ surface water sources which use filtration or equivalent -# & % of non-community systems w/ surface water sources which use filtration or equivalent			-# persons served by systems in SNC & % of total population served by PWS -# persons served by systems in full compliance & % of total population served by PWS -DW Quality Trend index	
Wetlands	-Acreage of wetland mitigated for – types lost/gained -Staff time spent on major vs. minor wetland projects -% projects w/ substantive comments -# signif. envmtl. issues raised & # resolved -# enforcemt actions & # resolved -# permits denied due to EPA comments	-Project types impacting wetlands	-Cu. yds. dredged material allowed in-water & upland in Columbia R. & Puget Sound	-Acres & types wetlands lost -Acres wetlands impacted -Acres wetlands protected by project modification, w/drawal or permit denial -Linear feet of shoreline impacted by state -Acres wetland preserved or replaced as result of enforcement action		

Table 2 (Continued)

Environmental Indicators in Region 10

FY 89 & Beyond

Program	Level 1 *Actions by States/EPA*	Level 2 *Actions by Sources*	Level 3 *Emission/ Discharge*	Level 4 *Ambient Concentrations/ Quantities*	Level 5 *Uptake/ Body Burden*	Level 6 *Health Effects; Ecological Effects; Other Effects*
Water Division:						
Ground Water	-LUST: # leaking tank cleanups initiated & controlled -Pest: # leachable active ingredients registered for use in WA, ID, OR vs. # registered nationally	-UST: # & % of corrosion-protected tanks in use -Haz. Waste: Site characterization status -Pesticides: Surrogate measure of the quantity of leachable pest. in use in vulnerable GW areas (being reviewed for use after 1990)		-DW: % DW & monitoring wells w/ nitrates above a level of concern -DW: # & % GW PWS in viol. of chemical MCLs or M/R -HW: # & % of HW sites w/ GW contamination above a health advisory or MCL -Pesticides: Results of state/national surveys to be evaluated for use	-DW: Population at risk from PWS in violation of MCLs or M/R -HW: Population at risk from HW contaminants approaching & in DW wells	
Air & Toxics Division:						
Air	-Air Toxics: Local risk assessments, esp. high risk point sources -Asbestos: Track notifications, inspections & NOVs vs. # violations -Radon: track public ed./assistance provided -Air Toxics: Development of state regs	-Enforcement: Track significant violators -Radon: Estimate % pop. in high risk areas who have monitored/mitigated their homes	-Criteria Pollutants: Emission inventory data -Enforcement: Case studies of enf. resulting in emission reductions	-Criteria pollutants: ambient concentrations -Photo History: Before/after photos of air quality problems/effects (opt.)		
Toxics		-PCBs: Compliance rates for inspections (revisit in FY 90) -PCBs: Equipment removed from service early due to settlemt negotiations -PCBs: Early disposal by BPA -Asbestos (AHERA): Schools' compliance w/ various program deadlines			-PCBs: residues in biota	

Table 2 (Continued)

Environmental Indicators in Region 10
FY 89 & Beyond

Program	**Level 1** *Actions by States/EPA*	**Level 2** *Actions by Sources*	**Level 3** *Emission/ Discharge*	**Level 4** *Ambient Concentrations/ Quantities*	**Level 5** *Uptake/ Body Burden*	**Level 6** *Health Effects; Ecological Effects; Other Effects*
Air & Toxics Division:						
Pesticides		-Public complaint data from state enforcement logs		-Pesticides in drinking water (EPA's National Drinking Water Well Survey) -Region 10 ESD sediment watch -Region 10 Puget Sd. program -USGS Yakima River Study	-Pesticides in biota (EPA's National Bioaccumulation Study) -Spokane Co. Health District cholinesterase testing program	-Region 10 worker protection study
Hazardous Waste Division:						
RCRA	-Prevention: Dev. RCRA indicator re: prevention of GW contamination -Documentation of success: Dev. & circulate notebook	-Remedial: Status of GW contamination cleanup at RCRA sites -Waste Min./Source Reductn/Recycling: Dev. RCRA indicator -Municipal Solid Waste: Dev. RCRA indicator		-Remedial: Envmtl improvemt/ progress at RCRA sites on a case-by-case basis		
Superfund	-Program accomplishments as per SCAP & SPMS measures			-Groundwater, soils, and surface materials investigation and cleanup at NPL sites NOTE: Any environmental indicators adopted by HQ will be implemented.		-# non-NPL sites where surface materials rep. public health or envmtl exposure problem -# non-NPL sites where removals stabilized or eliminated threats -Photo documentation where possible

Organization of the Report

This document is a compilation of reports presented by the program offices in Region 10 under the direction of the Deputy Regional Administrator and the Policy, Planning and Evaluation Branch. With minor variations in format, each chapter addresses the following basic components:

1. **Introduction** - Pertinent programmatic background information;
2. **The Environmental Indicator(s)** - A descriptive title with a narrative explaining how the indicator measures environmental quality or progress;
3. **Limitations** - A discussion of how the measure falls short in describing environmental quality;
4. **Results** - Presentation of data in the form of graphs/tables/maps with accompanying interpretation;
5. **Future Directions** - Plans for modification of present indicators and/or development of future ones.

Each program is responsible for reporting on the measures which they have selected with the assistance, in many cases, of the Environmental Services Division.

The programs' reports are organized according to air, water and land media, realizing that there are obvious cross-media concerns for all programs. One program's measures are not necessarily developed in isolation of other programs. For example, the Office of Ground Water works actively with hazardous waste, drinking water, pesticides, and the Environmental Services Division to formulate their environmental indicators.

For conformity, the FY 88 environmental indicators (which are the measures discussed in the summary reports) are listed at the beginning of each chapter. Following each report is a list of the modified indicators to be used for FY 89 and beyond.

Surface Water Environmental Indicators
FY 88

General

1. **Summary of Waters Fully, Partially, or not Supporting Uses**
2. **Waterbody Tracking System**
    a. Listing of waterbody status
    b. Listing of water quality-limited segments
    c. Limiting parameters for WQL segments
    d. List of all permits allowing discharges to WQL segments
    e. Listing of WQL segments for which all water quality-based controls have been implemented
    f. The loadings of pollutants to WQL segments broken down into point and nonpoint source components
3. **NPDES Permits**
    a. Number/percentage of permits with biomonitoring requirements
    b. Number of water quality-based permits issued
    c. Number of water quality-based permits with toxics limits
    d. Total loading limits for toxics
4. **Aerial Lakeshore Analysis for North Idaho Lakes**
5. **Status of Classified Shellfish Areas**
6. **Water Quality Index** (with stream maps)
7. **Pacific Northwest Rivers Study Database**
    (Includes information on resident fish, wildlife, recreational resources, natural and cultural features)

Basin Pilot Projects

1. **Yakima River Basin**
    a. Number of salmonid smolts produced
    b. Temperature
    c. Nutrient levels
    d. Riparian vegetation inventory
    e. Toxics concentrations
2. **Tualatin River Basin**
    a. Dissolved oxygen levels
    b. Nutrients/chlorophyll a
3. **Chehalis River Basin/Grays Harbor**
    a. Percent catch in ocean fishery
    b. Na-ATPase levels in smolting salmon
    c. Coho salmon smolt production
    d. Coho salmon escapement

Chapter 1: Surface Water

Introduction

There is a recognized need to establish better indicators of the "health" of environmental systems. Such indicators are important in assessing the current status and trends of pollution in surface waters, in evaluating the effectiveness of environmental programs in controlling pollution, and in determining priorities and directions for future water quality management efforts.

This effort is a continuation of that begun last year to develop and track more meaningful environmental indicators. The focus of this year's effort will be on tracking indicators for which more current information is available. Indicators for which no new information is available, or which change so slowly that they do not merit evaluation on an annual basis, will not be discussed in detail. This applies primarily to indicators such as the status of shellfish growing areas, for which information is compiled on a regional/national basis only at 4-5 year intervals, or the Pacific Northwest Rivers Study, which is not expected to be revised significantly in the next 1-2 years.

Significant sources of new information on the status of surface waters in Region 10 are in the process of being developed as part of the many assessment reports required of states by the amended Clean Water Act (referred to hereafter as "the Act"). These assessments address the general quality of surface waters, the effect of nonpoint sources on surface (and ground-water) quality, and the effect of toxic pollutants on surface waters. Where available, the results of these assessments are incorporated into the appropriate indicators.

Summary of Significant Accomplishments to Date

The Office of Water Planning is committed to the on-going development of improved environmental indicators. As such, the office was involved in a number of activities during the past year directly related to the tracking and improvement of indicators. The more significant of these activities were:

- Updating, where possible, information on the environmental indicators for surface water quality evaluated in 1987.

- Providing guidance to the states during development of the surface water quality assessments required by the Clean Water Act. These assessments included an overall evaluation of surface water quality as required under Section 305(b) of the Act, an assessment of waters adversely affected by nonpoint source pollution (as required in Section 319 of the Act), and an assessment of waters adversely affected by toxic pollutants (as required by Section 304(l) of the Act). As of the writing of this report, Washington had submitted its final reports, while Oregon and Idaho had submitted draft reports. Alaska has not yet submitted its draft reports.

- Region 10 Water Division initiated an effort to get the states to summarize the results of the various assessments. The Region 10 Water Division Director then met with the state water program directors to discuss the following issues:

  - What are the major water quality problems faced by each state?
  - What are the states' abilities to address these problems?
  - What additional actions are needed to address the problems, and what resource options are available for completing these actions?

  The hope was that states and Region 10 would use this information to identify water quality priorities, and these priorities would drive state/EPA Region 10 and EPA Region 10/EPA Headquarters negotiations for work commitments and resources.

- A U.S. Forest Service employee was detailed to EPA for one year to assist in the development of monitoring plans for National Forests in Region 10. The purpose of the detail was to encourage the national forests to incorporate better environmental indicators into their monitoring programs. The assignment of the USFS employee to EPA took much longer than initially expected, and the detail did not begin until September 26, 1988. The assigned individual is a Forest Hydrologist, and will have a lead role in negotiating the monitoring plans for selected national forests. A revised plan of work for this task is currently being prepared.

- EPA Region 10 and EPA Headquarters jointly sponsored an evaluation to identify environmental indicators for assessing the effectiveness of nonpoint source controls. The report, entitled "Effectiveness of Agricultural and Silvicultural Nonpoint Source Controls," was completed in May, 1988. The report catalogs and summarizes many of the data collection activities that are part of nonpoint source control programs in the Pacific Northwest. The report also presents an inventory of the environmental features and beneficial uses that have been monitored and the techniques that have been used. It evaluates and summarizes the current status of nonpoint source monitoring efforts in the Pacific Northwest. An approach to monitoring effectiveness of nonpoint source control programs is recommended along with suggested guidelines for selection of environmental parameters and techniques. Techniques used to measure aspects of living aquatic resources are emphasized.

- Efforts have been made to incorporate the use and understanding of environmental indicators into the education system at various academic levels, with the goals of making the public and educators more aware of environmental indicators and the needs of management and regulatory agencies, and providing baseline information on the status and trends of environmental quality. The efforts to date have focussed on four areas:

1. Contact with special university programs such as the Center for Streamside Studies at the University of Washington, which will focus on forestry-fishery interactions, and the COPE (Coastal Oregon Productivity Enhancement) Program at Oregon State University, which focuses on marine waters issues. The goal of this effort is to make these groups aware of EPA's interests in these programs and EPA needs that such groups might fulfill.

2. Coordination with the Governor's Watershed Enhancement Program in Oregon. One of the mandates of this program is to develop curricula for public school systems relating to the use and management of riparian systems. Region 10 is currently negotiating with EPA Headquarters for funding of a pilot project to develop a guidebook on the health of riparian systems. The guidebook would allow high school students to conduct "stream walks" for the purpose of assessing the status and health of riparian systems. Conceivably, a large number of these "walks" throughout the state could provide an extensive picture of the health of riparian systems state-wide. The Watershed Enhancement Program will be developing a computerized database for cataloging the information generated, which would eventually allow students and educators to evaluate not only the status, but also trends in riparian systems.

3. Discussions have been held with university and community college professors to encourage class projects using the rapid bioassessment procedures being developed by EPA for evaluating the health of stream biota. Several benefits could result from this effort. Hopefully, the students learning these techniques will expand their use in the future. In addition, the techniques will be evaluated and further developed in other systems (e.g., estuarine areas). Also, it is hoped that management agencies will be notified as problem areas are identified. Eventually, it is possible that regional conferences could provide an opportunity for students to present their findings to their peers to facilitate information exchange.

4. An effort is being made to initiate a competition among high school students in developing videos of some aspect of water pollution. The theme during the first year will be on the problem of plastic wastes in the marine environment. It is possible that a reward may be available for the winning video entry as an extra incentive to students. If the project is successful, a different theme would be developed each year.

- An aerial lakeshore analysis of north Idaho lakes was conducted jointly by EPA, the Idaho Department of Health and Welfare, and a private contractor. The survey was intended to identify potential sources of eutrophication along the lake shorelines. This approach was very successful in meeting this goal.

- The Near Coastal Waters (NCW) program has recently initiated assessments of several coastal ecosystems. This process requires consideration of what factors, or environmental indicators, provide a good measure of the environmental health of these systems.

  The Oregon NCW Pilot Project was funded to develop methods to assess and manage water quality related problems in Oregon's near coastal waters. The Coquille River estuary was selected to be a case study for that project due to its problems with low dissolved oxygen, bacterial contamination of shellfish, habitat alteration, possible toxics contamination, and salmon runs.

  Region 10 has also funded Oregon State University and the University of Washington to use students to assess water quality related problems in the lower Columbia River estuary, Willapa Bay, and Port Townsend Bay. This effort will involve reviewing existing literature and interviewing environmental professionals and local people to discover indications of environmental problems in these areas.

  Additional support has been given to the Oregon Department of Environmental Quality for analysis of fish tissue samples from the lower reaches of the Willamette River and to the Washington Department of Ecology to conduct a pesticide survey in the north end of Willapa Bay.

  Although the activities described above are just getting started, the information leading to their being funded shows that fish and shellfish are valuable early environmental indicators:

  - shellfish contamination has caused closures of shellfish beds in Oregon and Washington

  - skin lesions are observed on bottom fish in parts of Puget Sound

  - reduced returns of salmon to Grays Harbor indicate excess mortality; lowered ATPase levels appear to be related to this problem
  - pen-reared Atlantic salmon in Port Townsend Bay have suffered very high mortality due to liver disease

- Two pilot project evaluations in the Tualatin and Yakima River basins were continued, emphasizing whether the environmental indicators used in the past properly reflect appropriate management needs in the basin and whether the proposed management actions properly reflect knowledge of limiting factors in the basins.

- Progress in determining the cause of increased coho salmon mortality in fish migrating through the Chehalis River and inner Grays Harbor was closely followed, as a number of new and innovative measures of fish health are being examined in this study. While much of the data collected during the past year has not yet been analyzed, some of the available results are discussed later in this report. Additional EPA resources will be devoted to supporting continued work in FY89. The results available from the 1988 sampling support the theory that water quality conditions in inner Grays Harbor are stressing the coho salmon and reducing their ability to deal with other stresses (e.g., disease). The focus of the studies in 1989 will thus be on identifying the specific water quality problem and, if due to human caused pollution, the pollution sources.

Summary of Indicators

1. Waters fully, partially, or not supporting uses

Information on the waters fully, partially, or not supporting designated beneficial uses was compiled as part of the 1988 305(b) reports. However, at the time this report was written, Washington was the only state having submitted a final 305(b) report. Oregon and Idaho have submitted draft reports, but Idaho's did not contain detailed information on use attainment. No information is available for Alaska, which has not submitted a draft 305(b) report. Information from the 1986 305(b) reports was used when data from 1988 were not available. The resulting information appears in Tables 1.1-1.6. While it appears from the tables that a high percentage of the waters assessed do not fully support the designated uses, it must be noted that a disproportionate percentage of water quality monitoring is focussed on suspected or known problem areas (e.g., near major population centers or agricultural areas).

Limitations

A major limitation in the use of this information is that states have developed differing approaches to compiling information and classifying waters. For example, some states will classify a waterbody as supporting uses if there are few or no known sources of pollution, even though no water quality monitoring or assessments have been conducted. Such states often indicate that high percentages of the state's waters are assessed during development of state 305(b) reports. Other states are hesitant to do this, however, and often show low percentages of waters monitored and assessed. These differing approaches create difficulties when the results of the various states are combined into national figures. Region 10 has tried to correct this problem through issuance of our regional guidance on 305(b) reporting.

Another major concern with this measure is the lack of problem specificity. Simple listings of the percentage of waters partially or not supporting uses does not indicate the major types of pollution problems states are facing, the magnitude or frequency of criteria exceedances (and thus the level of use impairment), or geographic areas where a number of activities threatening uses are concentrated.

On the positive side, this "indicator" still provides a general overview on the status of water quality within the Region. In addition, this is one of the few indicators which, despite its problems, is consistently compiled on a national basis. A major emphasis in the future will be for states to increase the amount of waters assessed. The management goal for this indicator is to have all waters listed as fully supporting the designated uses.

Chapter 1: Surface Water

Table 1.1

Designated use support in rivers in Region 10. Values represent the number of linear stream miles in each category.

ND = No Data

State	Total Miles	Miles Supporting	Miles Threatened	Miles Partially Supporting	Miles Not Supporting	Total Miles Assessed
AK	365,000	2,662	ND	1,447	916	5,025
ID	16,146	6,046	ND	572	692	7,310
OR	90,000	12,546	0	8,497	6,695	27,738
WA	40,492	2,295	1,269	1,608	718	4,621
Totals:	**511,638**	**23,549**	**1,269**	**12,124**	**9,021**	**44,694**

Table 1.2

Sources of nonsupport of designated uses in rivers in Region 10. Values represent the number of linear stream miles affected by each type of activity.

ND = No Data

State	Agriculture	Silviculture	Construction	Urban Runoff	Resource Extraction	Land Disposal	Hydro/Habitat Modification	Other
AK	13	ND	178	88	1,221	98	25	0
ID	12,097	ND	576	0	380	208	ND	757
OR	16,910	7,580	1,420	1,675	2,280	0	0	12,362
WA	2,690	412	337	484	105	394	1,899	2,111
Totals:	**31,710**	**7,992**	**2,511**	**2,247**	**3,986**	**700**	**1,924**	**15,230**

Table 1.3

Designated use support in lakes in Region 10. Values represent the total number of acres in each category.

ND = No Data

State	Total Acres	Acres Supporting	Acres Threatened	Acres Partially Supporting	Acres Not Supporting	Total Acres Assessed
AK	12,787,200	ND	ND	ND	ND	ND
ID	727,202	ND	ND	ND	ND	ND
OR	500,000	ND	ND	ND	ND	ND
WA	613,582	122,834	116,210	33,104	580	156,518
Totals:	**14,627,984**	**122,834**	**116,210**	**33,104**	**580**	**156,518**

Table 1.4
Sources of nonsupport of designated uses in lakes in Region 10. Values represent the total number of lake acres affected by each type of activity.
ND = No Data

State	Agriculture	Silviculture	Construction	Urban Runoff	Resource Extraction	Land Disposal	Hydro/Habitat Modification	Other
AK	ND	ND	ND	ND	ND	ND	ND	ND
ID	ND	ND	ND	ND	ND	ND	ND	ND
OR	ND	ND	ND	ND	ND	ND	ND	ND
WA	33,104	0	0	33,684	0	0	580	66,788
Totals:	**33,104**	**0**	**0**	**33,684**	**0**	**0**	**580**	**66,788**

Table 1.5
Designated use support in estuaries in Region 10. Values represent the total estuarine surface area (in square miles) for each category.
ND = No Data

State	Total Area	Area Supporting	Area Threatened	Area Partially Supporting	Area Not Supporting	Total Area Assessed
AK	ND	ND	ND	ND	ND	ND
ID	ND	ND	ND	ND	ND	ND
OR	206	ND	ND	ND	ND	ND
WA	2,943	1,937	293	91	86	2,114
Totals:	**3,149**	**1,937**	**293**	**91**	**86**	**2,114**

Table 1.6
Sources of nonsupport of designated uses in estuaries in Region 10. Values represent the total estuarine surface area (in square miles) affected by each type of activity.
ND = No Data

State	Agriculture	Silviculture	Construction	Urban Runoff	Resource Extraction	Land Disposal	Hydro/Habitat Modification	Other
AK	ND	ND	ND	ND	ND	ND	ND	ND
ID	ND	ND	ND	ND	ND	ND	ND	ND
OR	ND	ND	ND	ND	ND	ND	ND	ND
WA	109	25	0	54	0	98	30	282
Totals:	**109**	**25**	**0**	**54**	**0**	**98**	**30**	**282**

2. Waterbody Tracking System

EPA's computerized Waterbody Tracking System was initially intended to be required for use in developing the 1988 305(b) reports. However, delays in completing the development and debugging of the software caused the agency to back away from this requirement. Washington, whose effort to input data into the Tracking System was supported by EPA as a pilot project, was the only state in Region 10 to adopt and use the system. State personnel generally felt their experiences in using the system were good, and are committed to continued use of the system. Alaska has already begun developing the system, and should have it operating and fully functional by 1990. Oregon and Idaho are in the process of developing alternative data management systems for tracking waterbodies. Oregon will use a Geographic Information System (ARC-INFO), while Idaho is using a system developed on its MacIntosh computers. It is anticipated that programs will be developed to download information from both Oregon's and Idaho's waterbody management systems into EPA's Waterbody Tracking System. The ability to track water quality-limited waterbodies, as proposed in last year's report, will not be possible until the state management systems are fully functional.

3. NPDES Permits

While not providing a direct measure of ambient conditions, a set of "indicators" has been developed which will allow tracking of those permit requirements reflecting efforts to control adverse effects to water quality. The items tracked are:

a. Number of permits with biomonitoring requirements (see Table 1.7);

b. Number of permits with water quality-based limits (see Table 1.8);

c. Number of permits with water quality-based limits for toxic pollutants (see Table 1.8).

As water quality concerns are more closely considered in permit development, the number of permits containing biomonitoring requirements and water quality-based limits is expected to increase.

Limitations

Weaknesses with these indicators are that they do not address whether all dischargers needing water quality-based controls are known, and what percentage of needed water quality-based controls have been implemented. They also do not indicate whether the controls incorporated into the permits are adequate to fully protect water quality. Use of the Water Body System, or compatible state systems, should help address these concerns.

Considerable effort was needed last year to compile the information on NPDES permits. As a result, a permit checklist was developed which could be filled out during permit development or review. The checklist was distributed to Region 10 permit writers/reviewers and was completed for all major permits. The checklists have also proved useful for tracking a number of SPMS and RAS measures.

Results

a. Biomonitoring

The number and percentage of permits containing biomonitoring requirements which were issued in Region 10 as of September, 1988 are listed in Table 1.7. Figure 1.1 compares the numbers of these permits, by state, with the numbers from June, 1987. As can be seen, the most significant increase in numbers occurred in Alaska, largely from permits for offshore oil and gas facilities. Some of the oil and gas permits were general permits, and thus would apply to a number of individual facilities. Hence, the number of facilities which actually conduct biomonitoring is underestimated.

Table 1.7
Number and percentage of permits in Region 10 containing biomonitoring requirements as of September 30, 1988

	Alaska	Idaho	Oregon	Washington	Total
No. Permits	14	6	16	40	76
Percent of Total Permits	**1.0**	**1.4**	**1.7**	**4.3**	**2.1**

b. Water Quality-Limited Permits

Tracking implementation of water quality-based controls should be a particularly useful environmental indicator. When used in association with the Water Body System, it will indicate when all point sources are controlled on segments with serious water quality problems. It will alert managers that management activities on such segments should shift to monitoring and, as necessary, to nonpoint source controls.

Implementing water quality-based controls is a state responsibility, and, if the states default, a regional responsibility. Unless the states begin to track such implementation, or EPA completes the work in their stead, we will have no way of knowing when our mutual responsibilities for protecting water quality under Section 303 have been fulfilled.

The number of permits with water quality-based limits is shown, by state, in Table 1.8. It is apparent that the trend towards development of water quality-based permitting is strongest in the two states in Region 10 for which EPA writes NPDES permits. The states with delegated permitting authorities have developed fewer such permits. This is not surprising, considering that EPA has been the instigating force behind development of water quality-based permits. It is expected that the delegated states will respond by developing greater numbers of water quality-based permits as they become more familiar with EPA's water quality-based permit limit derivation procedures.

4. Aerial Lakeshore Analysis for Northern Idaho Lakes

Region 10, Idaho Department of Health and Welfare (IDHW) and a company called Enviroscan, completed an aerial survey of over 100 miles (seven lakes) of shoreline along north Idaho lakes using aerial remote sensing by multi-spectral photoanalysis and interpretation. This type of survey technique yields qualitative rather than quantitative information.

It highlights suspected sources and types of loadings to waters for further quantitative analysis by water quality staff. The purpose of this project was to evaluate this technique for identifying sources and types of watershed loading to north Idaho lakes.

The project was completed in January 1988. Potential point and nonpoint toxic and nutrient problems were identified and ranked for further groundtruthing. A final report was prepared and a set of slides were obtained as a permanent record of current land use impacts for future comparison.

IDHW is currently in the process of going through the multitude of color and infrared slides and verifying point and nonpoint sources of pollution. The staff has groundtruthed the shorelines of three of the seven lakes, presented the slides during several educational public meetings, identified high priority sites contributing major or significant potential pollution and coordinated fieldwork with the Panhandle Health District.

This fall, EPA-EMSL will be completing a remote sensing reconnaisance over northern Lake Pend Oreille and the upper reaches of the Pend Oreille River as part of a study mandated by Section 525 of the Act. This will provide us an opportunity to compare Enviroscan's work to that of EMSL and to explore how to use this tool in future work.

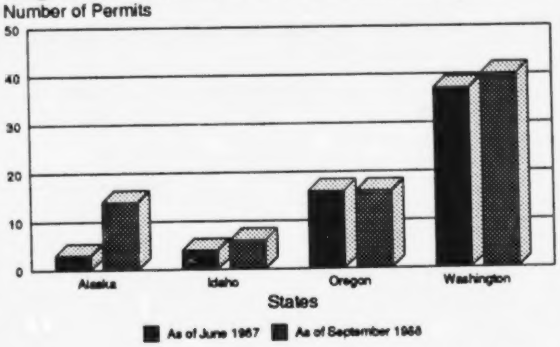
Table 1.8

Number of NPDES permits issued in Region 10 during FY 88 containing water quality-based limits

	Alaska	Idaho	Oregon	Washington	Total
No. Permits (All Pollutants)	19	10	2	5	36
No. Permits (Toxic Pollutants)	19	9	0	5	33
Percent of Permits Issued During FY88	25%	22%	30%	14%	15%

Figure 1.1

Region 10 Permits with Biomonitoring



This technique appears to be a valuable tool for guiding lake restoration efforts. Already we have been surprised by preliminary results for Lake Pend Oreille which indicate that nonpoint loading by nearshore residents plays a minor role in lake water quality. A summary of lessons learned from this project is presented below:

Strengths

- The photographs provide a baseline of information for future reference.
- The photographs provide a watershed perspective of a lake as part of a watershed system.
- The photographs help to locate previously undetected and potential pollution sources.
- Groundtruthing detected pollution sources that either were undetected by or occurred subsequent to the reconnaisance.
- Lake sites for water quality sampling can be efficiently selected through this process.
- The analyses complement IDHW's citizen volunteer monitoring program as an educational tool.
- The photographs are helpful in IDHW's public education work. They illustrate to people how their small, somewhat insignificant actions can cumulatively affect lake water quality and also guide them as they make their long range environmental plans.

Weaknesses

- Access to private property for groundtruthing is often difficult or impossible to obtain.
- Lush natural vegetation, well-watered lawns and lawn diseases can be falsely interpreted as nutrient-rich septic system sources.
- Lakeshore landmarks can change from year to year and season to season, making it difficult to pinpoint objects and/or locations.
- Because the macrophyte component of analysis is dependent on water clarity, algal blooms can severely limit interpretive capabilities.
- Quality control for the photographs should be carefully evaluated if this technique is repeated in future years.

5. Status of Classified Shellfish Areas

No new information is available for this indicator, which was extensively covered in last year's report. The National Shellfish Register, the source of this information, is currently being updated. The update is scheduled for completion in 1989. When completed, the information will be compared to that for previous years.

6. Water Quality Index (WQI)

The states in Region 10 have established water quality standards to protect the quality of state waters for a variety of uses, including public water supply, wildlife, fish and shellfish, recreation, navigation, agriculture, and industry. Each water use depends on certain characteristics, such as temperature, concentration of dissolved oxygen, or absence of bacteria, which can be measured and used to evaluate water quality. They vary with the chemistry of the waterbody being measured, the season, and other factors.

To compare water quality of rivers on a regional scale, EPA Region 10 developed a standardized set of parameters and associated criteria and segregated them into ten related groups (Table 1.9). These criteria are a synthesis of Region 10 state water quality standards, recommended federal criteria for parameters where no state standards exist, information in technical literature, and professional judgment. Like the state water quality standards, this more comprehensive set of criteria is intended to define water quality levels necessary to protect human health and aquatic life and the desired recreational uses of river and stream waters, and thus represents regional water quality goals. More than one criterion value based on water use may be associated with certain parameters. For example, most of the region's streams are managed to support cold water fish species such as trout and salmon; however, some are managed as warm water fisheries, supporting bass, bullhead, etc., which require less stringent criteria.

The water quality/beneficial use status for major river segments in three of the four Region 10 states were made by comparing water quality data measured from 1985 through 1987 with the parameter categories shown in Table 1.9. (Insufficient information was available for Alaska rivers to assess water quality.) This data is collected by various federal, state and local agencies and stored in EPA's STORET data base. Status was calculated per stream segment for each of the 10 parameter categories. Separate judgments of impairment were made based upon the severity and duration by which the criteria for various uses were exceeded. A judgment was also made regarding the most sensitive use and/or the worst three consecutive months. This approach provides an indication of worst case water quality problems occurring on a seasonal basis. In addition, an overall status was generated for the segment by an aggregation of the ten categories. The overall status for each stream segment was divided into one of four categories and colored maps generated as follows:

▢ *Beneficial use protected*
▨ *Beneficial use generally attained*
▩ *Beneficial use threatened*
■ *Beneficial use impaired*

Table 1.9
Criteria Categories for River Water Quality

Temperature. Water temperature influences the type of fish and other aquatic life that can survive in a river. High temperature can be detrimental to fish spawning and rearing.

Dissolved Oxygen. Fish and aquatic life must have certain levels of oxygen in the water to survive. Low oxygen concentration or saturation levels can be detrimental to these organisms.

ph. ph is the measure of hydrogen ion concentration in water and determines whether the water is acidic or basic. Extreme levels of either can imperil fish and aquatic life.

Bacteria. Bacteria indicate probable presence of disease-related organisms and viruses from human sewage or animal waste.

Trophic. Indicates the extent of algae or nutrients in water. Nutrients promote algal growth. When algae flourish they make the water murky and the growths make swimming and fishing unpleasant. Decomposition of dead algae can decrease dissolved oxygen concentrations to levels harmful to fish.

Aesthetics. Refers to oil, grease, turbidity and algal blooms which are visually unpleasant. Generally this group is represented by either turbidity or chlorophyll a. Turbidity is a measure of the clarity of the water. Chlorophyll a provides a measure of suspended algae in the water.

Solids. Dissolved minerals or suspended material such as mud or silt. Excess dissolved minerals interfere with agricultural, industrial and domestic use. Excess suspended solids adversely affect fish feeding and spawning.

Metals Toxicity. Excess concentrations of heavy metals such as arsenic, cadmium, chromium, copper, lead, mercury and zinc are toxic to human, aquatic and other life forms.

Organic Toxicity. Excess concentrations of pesticides, herbicides, PCBs and other organic substances that are toxic to humans, mammals, birds, fish and other water dependent life forms.

Ammonia Toxicity. Excess concentrations of ammonia in its un-ionized form are toxic to fish and other aquatic life forms.

The resulting maps are displayed in Figures 1.2(b), 1.3(b), and 1.4(b) for Washington, Oregon, and Idaho, respectively. Box chart displays for major stream segments in Washington, Oregon, and Idaho are also presented (Figures 1.2(a), 1.3(a), and 1.4(a) respectively). The water quality/beneficial use status for each of the 10 parameter categories per selected stream segments are shown according to the most sensitive use and/or the worst three consecutive months. This information was compared to similar data generated from 1980-1982 [Figures 1.2(a)-1.4(a)]. The information can thus be screened to identify areas where significant improvement or deterioration of water quality may be occurring. However, caution must be used in evaluating this information, as the box charts may not reflect true trends. For example, the water quality criteria for many metals have become more stringent than they were in 1980-1982. Thus a segment may have had more violations of criteria in 1985-1987 than in 1980-1982, and thus appear to have deteriorating water quality, even though actual concentrations of metals have remained fairly constant.

Several interesting trends are evident from the maps generated. First, the level of monitoring data collected by Washington, Oregon, and Idaho varies significantly. While rivers from throughout Washington have been sampled extensively, sampling in Oregon has been concentrated in the western half of the state. This may be purely a reflection of the paucity of major rivers in eastern Oregon, as both Washington and Oregon have fairly comprehensive, state-wide water quality monitoring programs. A much smaller percentage of the major rivers in Idaho have been sampled, however, indicating that the state's monitoring effort is much more limited.

It is surprising to note that most of the waters with threatened or impaired water quality in Washington occur in the eastern half of the state. This occurs despite the fact that most of the state's population is located around the Puget Sound basin in western Washington. It appears that agricultural activities, which are the predominant activities affecting water quality in eastern Washington, exert a strong influence on water quality. Overall, Washington appears to

Figure 1.2(a)

Water Quality Index Tables for the State of Washington

Current Status and Trends

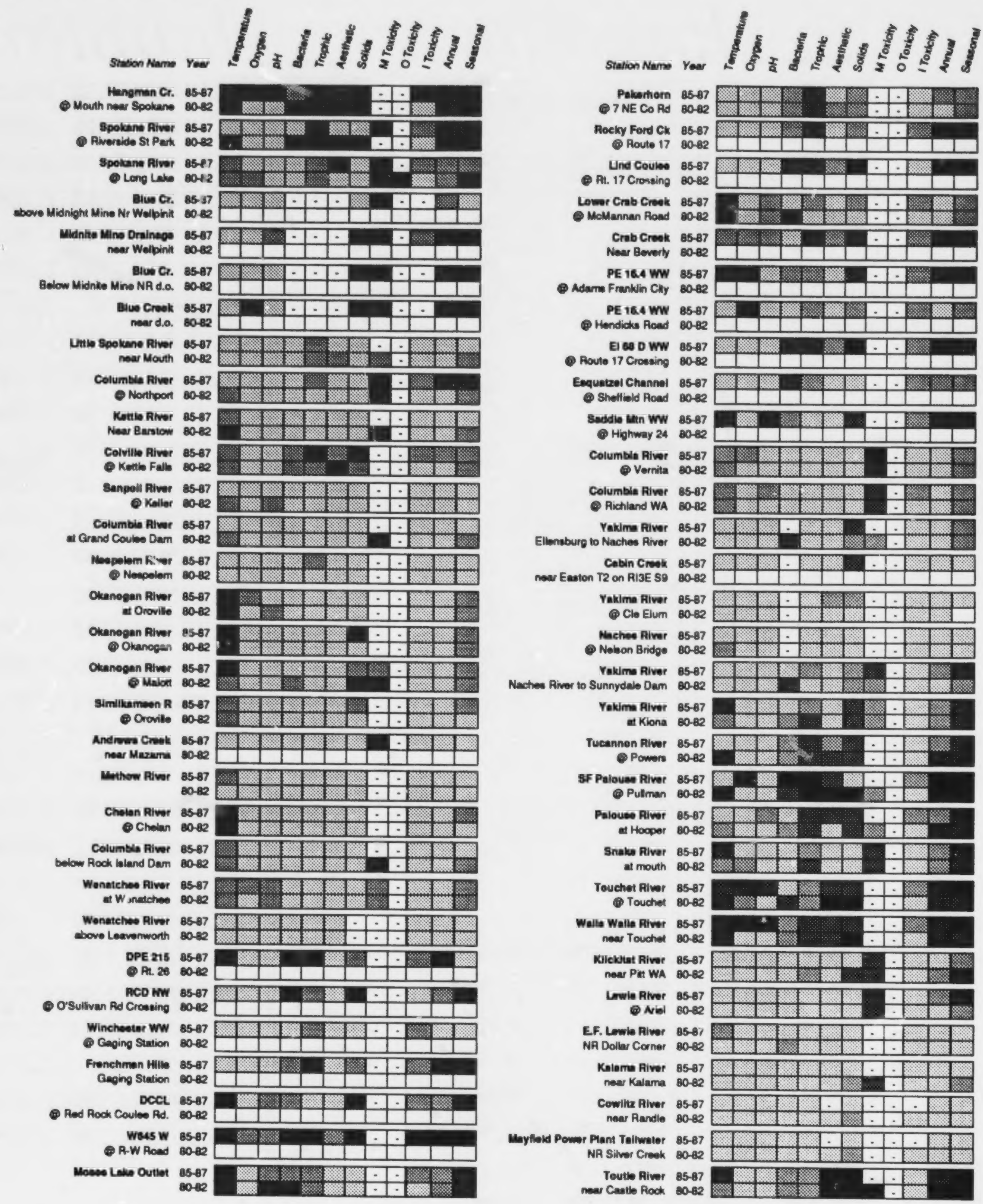
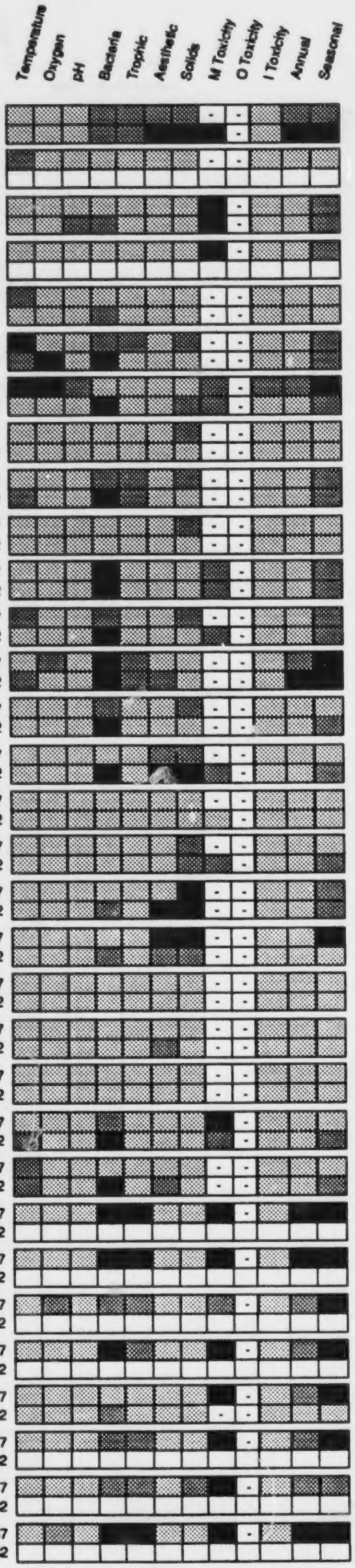
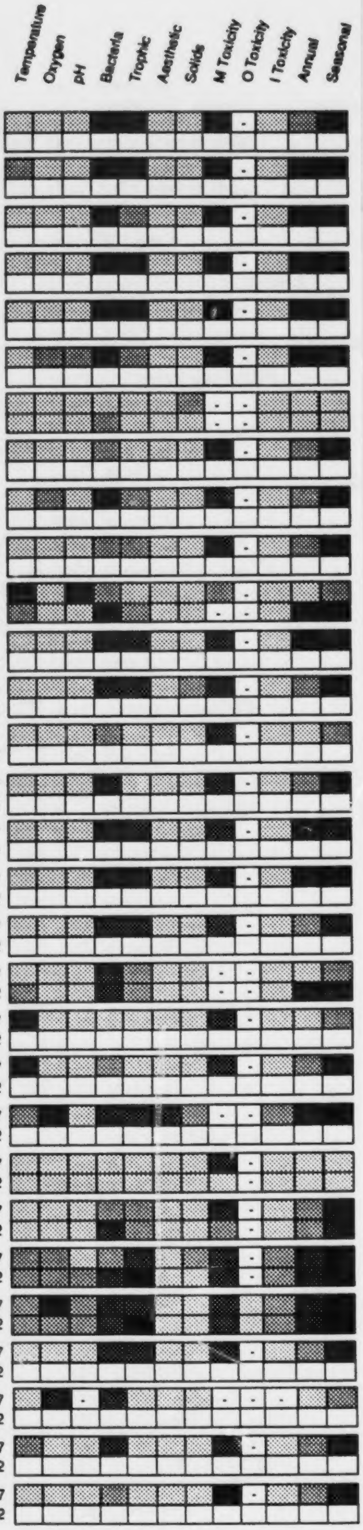


Figure 1.2(a)
Water Quality Index Tables for the State of Washington
Current Status and Trends *(Cont.)*


Temperature
Oxygen
pH
Bacteria
Trophic
Aesthetic
Solids
M Toxicity
O Toxicity
I Toxicity
Annual
Seasonal

Station Name	*Year*
Cowlitz River	85-87
@ Kelso WA	80-82
Coweman River	85-87
@ Kelso	80-82
Queets River	85-87
near Clearwater	80-82
N. Fork Quinault River	85-87
near Amanda Park WA	80-82
Chehalis River	85-87
@ Dryad	80-82
Chehalis River	85-87
@ Centralia	80-82
Chehalis River	85-87
@ Porter WA	80-82
Satsop River	85-87
near Satsop	80-82
Chehalis River	85-87
near Montesano	80-82
Humptulips	85-87
near Humptulips	80-82
Willapa River	85-87
@ Lebam	80-82
Willapa River	85-87
near Willapa	80-82
Sumas River	85-87
near Huntingdon B.C.	80-82
Samish River	85-87
near Burlington	80-82
Nooksack River	85-87
	80-82
Skagit River	85-87
@ Marblemount	80-82
Skagit River	85-87
near Mt. Vernon	80-82
SF Stillaguamish R.	85-87
@ Arlington	80-82
NF Stillaguamish River	85-87
@ Cicero	80-82
Skykomish River	85-87
near Gold Bar	80-82
Skykomish River	85-87
@ Monroe	80-82
Snoqualmie River	85-87
@ Snoqualmie	80-82
Snohomish River	85-87
	80-82
Pilchuck River	85-87
@ Snohomish	80-82
Kelsey Creek	85-87
	80-82
Forbes Creek	85-87
	80-82
Evans Creek	85-87
above Bear Creek (King County)	80-82
Juanita Creek	85-87
(King County)	80-82
Cedar River	85-87
above Renton	80-82
Mouth of May Creek	85-87
	80-82
Coal Creek	85-87
@ Cascade Key Road	80-82
Mercer Slough	85-87
@ I 90	80-82


Temperature
Oxygen
pH
Bacteria
Trophic
Aesthetic
Solids
M Toxicity
O Toxicity
I Toxicity
Annual
Seasonal

Station Name	*Year*
Yarrow Bay Trib.	85-87
	80-82
Fairweather Bay Tr.	85-87
	80-82
Lyon Creek	85-87
near Mouth	80-82
Mouth Thornton Creek	85-87
	80-82
McAleer Creek	85-87
	80-82
Tibbets Creek	85-87
@ Lake Sammamish	80-82
Cedar River	85-87
@ Logan St. Br. @ Renton	80-82
Issaquah Creek	85-87
above East Fork	80-82
North Fork Issaquah	85-87
above Gravel Pits	80-82
Issaquah Creek	85-87
@ Gaging Station	80-82
Sammamish R.	85-87
@ Marymoor Park	80-82
Evans Creek	85-87
@ Rt. 2 near mouth (blw Bear Cr.)	80-82
Bear Creek	85-87
blw Cottage Lk. Cr.	80-82
Bear Creek	85-87
abv Cottage Lk. Cr.	80-82
Cottage Lake Creek	85-87
	80-82
North Creek	85-87
@ Hwy. 522	80-82
Little Bear Creek	85-87
@ Mouth	80-82
Swamp Creek	85-87
@ Hwy. 522	80-82
Sammamish River	85-87
@ Bothell	80-82
Ship Canal	85-87
@ Montlake Br.	80-82
Ship Canal	85-87
above Locks	80-82
Mill Creek	85-87
(Springbrook Cr. trib-King Co.	80-82
Green River	85-87
above Auburn	80-82
Green River	85-87
Auburn to Renton STP	80-82
Duwamish River	85-87
Renton STP to 16th Ave. S. Br.	80-82
Duwamish Waterway	85-87
below 16th Ave. S. Br.	80-82
Newaukum Creek	85-87
	80-82
Newaukum Creek	85-87
North Fork	80-82
Little Soos Creek	85-87
	80-82
Jenkins Creek	85-87
@ Berrydale	80-82

Figure 1.2(a)
Water Quality Index Tables for the State of Washington
Current Status and Trends *(Cont.)*

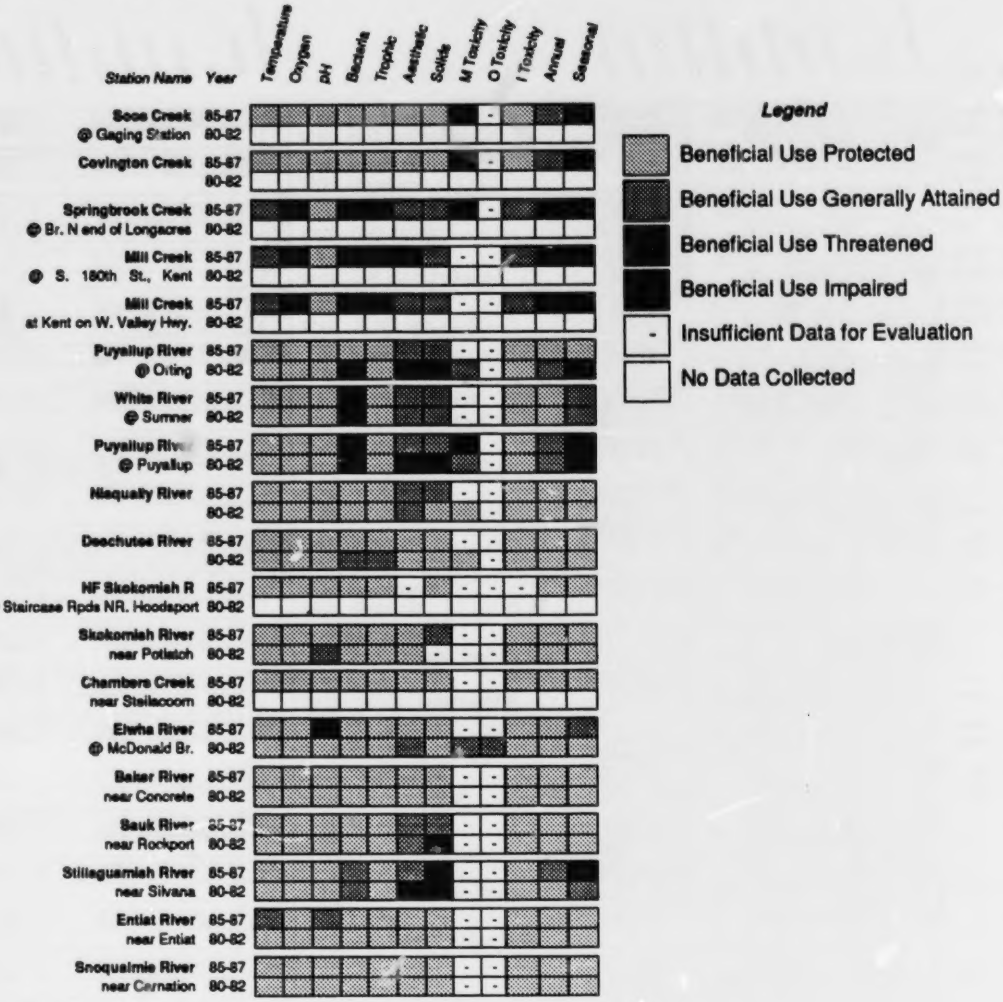

Temperature
Oxygen
pH
Bacteria
Trophic
Aesthetic
Solids
M Toxicity
O Toxicity
I Toxicity
Annual
Seasonal
Station Name
Year
Soos Creek @ Gaging Station 85-87 80-82
Covington Creek 85-87 80-82
Springbrook Creek @ Br. N end of Longacres 85-87 80-82
Mill Creek @ S. 180th St., Kent 85-87 80-82
Mill Creek at Kent on W. Valley Hwy. 85-87 80-82
Puyallup River @ Orting 85-87 80-82
White River @ Sumner 85-87 80-82
Puyallup River @ Puyallup 85-87 80-82
Nisqually River 85-87 80-82
Deschutes River 85-87 80-82
NF Skokomish R blw Staircase Rpds NR. Hoodsport 85-87 80-82
Skokomish River near Potlatch 85-87 80-82
Chambers Creek near Steilacoom 85-87 80-82
Elwha River @ McDonald Br. 85-87 80-82
Baker River near Concrete 85-87 80-82
Sauk River near Rockport 85-87 80-82
Stillaguamish River near Silvana 85-87 80-82
Entiat River near Entiat 85-87 80-82
Snoqualmie River near Carnation 85-87 80-82
Legend
Beneficial Use Protected
Beneficial Use Generally Attained
Beneficial Use Threatened
Beneficial Use Impaired
- Insufficient Data for Evaluation
No Data Collected

Figure 1.2(b)
Washington Water Quality, Based on Region 10 Water Quality Index

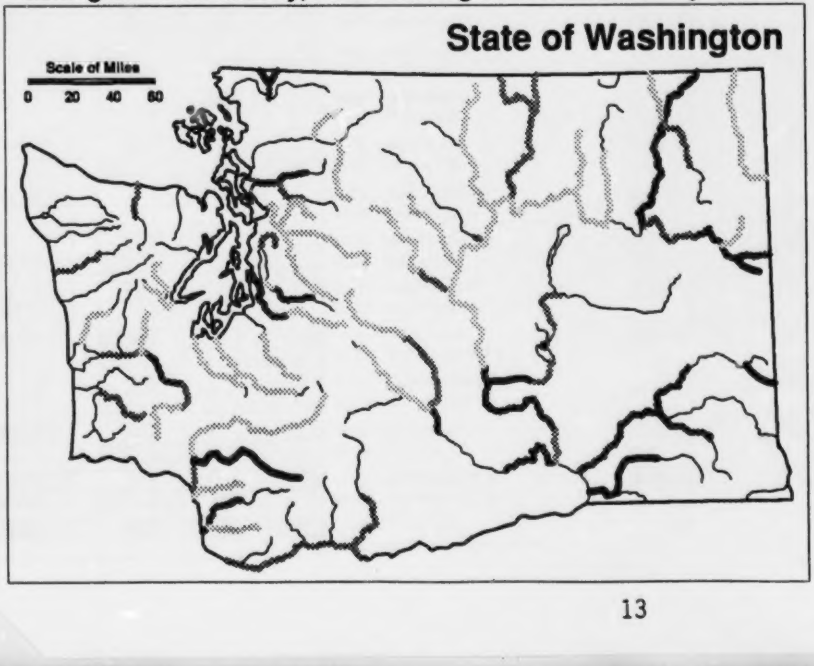
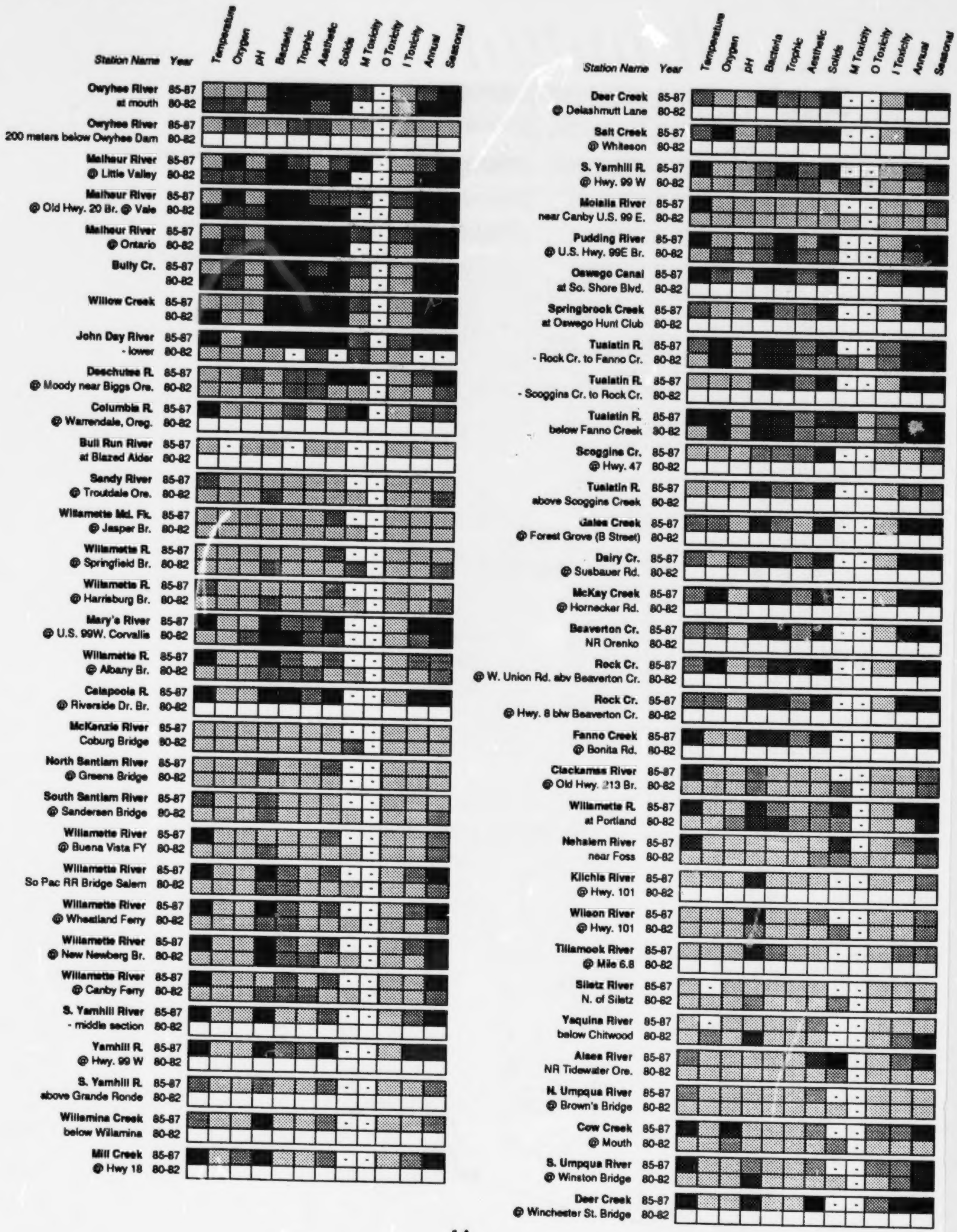

State of Washington
Scale of Miles
0
20
40
60

Figure 1.3(a)

Water Quality Index Tables for the State of Oregon

Current Status and Trends


Temperature
Oxygen
pH
Bacteria
Trophic
Aesthetic
Solids
M Toxicity
O Toxicity
I Toxicity
Annual
Seasonal

Station Name	Year
Owyhee River at mouth	85-87 80-82
Owyhee River 200 meters below Owyhee Dam	85-87 80-82
Malheur River @ Little Valley	85-87 80-82
Malheur River @ Old Hwy. 20 Br. @ Vale	85-87 80-82
Malheur River @ Ontario	85-87 80-82
Bully Cr.	85-87 80-82
Willow Creek	85-87 80-82
John Day River - lower	85-87 80-82
Deschutes R. @ Moody near Biggs Ore.	85-87 80-82
Columbia R. @ Warrendale, Oreg.	85-87 80-82
Bull Run River at Blazed Alder	85-87 80-82
Sandy River @ Troutdale Ore.	85-87 80-82
Willamette Md. Fk. @ Jasper Br.	85-87 80-82
Willamette R. @ Springfield Br.	85-87 80-82
Willamette R. @ Harrisburg Br.	85-87 80-82
Mary's River @ U.S. 99W. Corvallis	85-87 80-82
Willamette R. @ Albany Br.	85-87 80-82
Calapooia R. @ Riverside Dr. Br.	85-87 80-82
McKenzie River Coburg Bridge	85-87 80-82
North Santiam River @ Greens Bridge	85-87 80-82
South Santiam River @ Sandersen Bridge	85-87 80-82
Willamette River @ Buena Vista FY	85-87 80-82
Willamette River So Pac RR Bridge Salem	85-87 80-82
Willamette River @ Wheatland Ferry	85-87 80-82
Willamette River @ New Newberg Br.	85-87 80-82
Willamette River @ Canby Ferry	85-87 80-82
S. Yamhill River - middle section	85-87 80-82
Yamhill R. @ Hwy. 99 W	85-87 80-82
S. Yamhill R. above Grande Ronde	85-87 80-82
Willamina Creek below Willamina	85-87 80-82
Mill Creek @ Hwy 18	85-87 80-82

Station Name	Year
Deer Creek @ Delashmutt Lane	85-87 80-82
Salt Creek @ Whiteson	85-87 80-82
S. Yamhill R. @ Hwy. 99 W	85-87 80-82
Molalla River near Canby U.S. 99 E.	85-87 80-82
Pudding River @ U.S. Hwy. 99E Br.	85-87 80-82
Oswego Canal at So. Shore Blvd.	85-87 80-82
Springbrook Creek at Oswego Hunt Club	85-87 80-82
Tualatin R. - Rock Cr. to Fanno Cr.	85-87 80-82
Tualatin R. - Scoggins Cr. to Rock Cr.	85-87 80-82
Tualatin R. below Fanno Creek	85-87 80-82
Scoggins Cr. @ Hwy. 47	85-87 80-82
Tualatin R. above Scoggins Creek	85-87 80-82
Gales Creek @ Forest Grove (B Street)	85-87 80-82
Dairy Cr. @ Susbauer Rd.	85-87 80-82
McKay Creek @ Hornecker Rd.	85-87 80-82
Beaverton Cr. NR Orenko	85-87 80-82
Rock Cr. @ W. Union Rd. abv Beaverton Cr.	85-87 80-82
Rock Cr. @ Hwy. 8 blw Beaverton Cr.	85-87 80-82
Fanno Creek @ Bonita Rd.	85-87 80-82
Clackamas River @ Old Hwy. 213 Br.	85-87 80-82
Willamette R. at Portland	85-87 80-82
Nehalem River near Foss	85-87 80-82
Kilchis River @ Hwy. 101	85-87 80-82
Wilson River @ Hwy. 101	85-87 80-82
Tillamook River @ Mile 6.8	85-87 80-82
Siletz River N. of Siletz	85-87 80-82
Yaquina River below Chitwood	85-87 80-82
Alsea River NR Tidewater Ore.	85-87 80-82
N. Umpqua River @ Brown's Bridge	85-87 80-82
Cow Creek @ Mouth	85-87 80-82
S. Umpqua River @ Winston Bridge	85-87 80-82
Deer Creek @ Winchester St. Bridge	85-87 80-82

Figure 1.3(a)

Water Quality Index Tables for the State of Oregon

Current Status and Trends *(Cont.)*

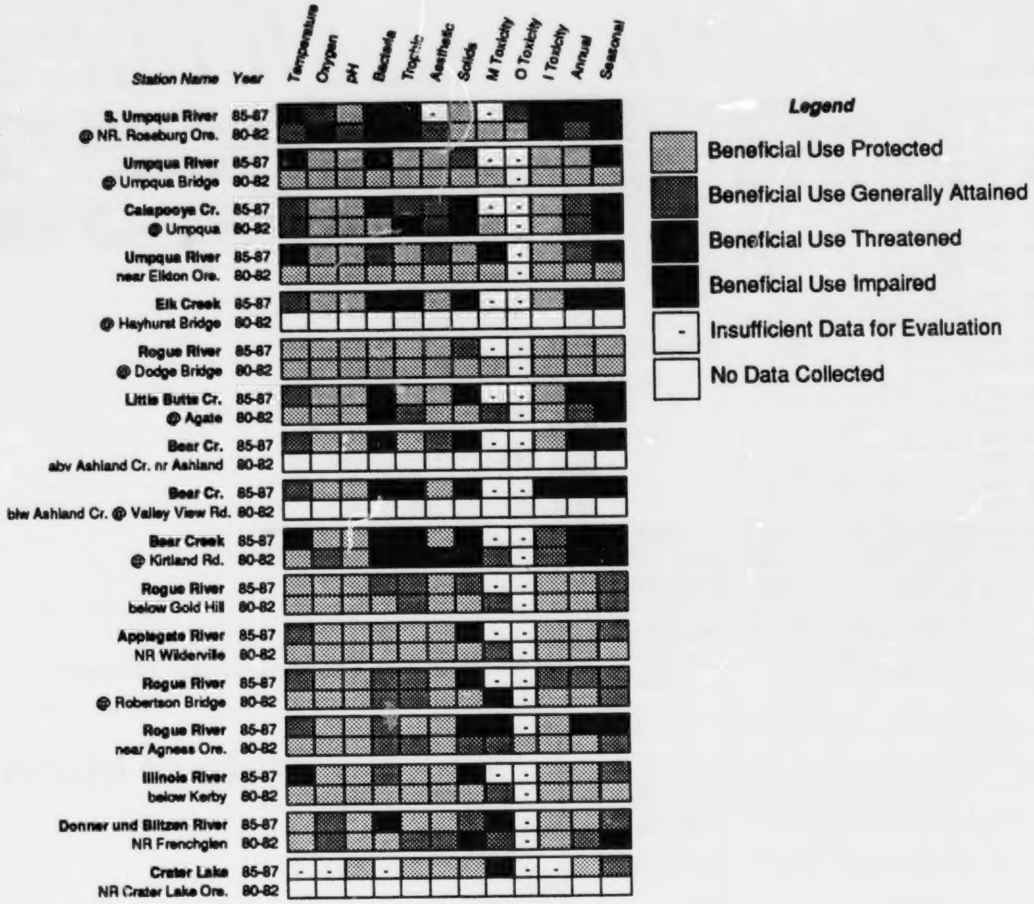

Station Name
Year
Temperature
Oxygen
pH
Bacteria
Trophic
Aesthetic
Solids
M Toxicity
O Toxicity
I Toxicity
Annual
Seasonal
S. Umpqua River @ NR. Roseburg Ore.
Umpqua River @ Umpqua Bridge
Calapooya Cr. @ Umpqua
Umpqua River near Elkton Ore.
Elk Creek @ Hayhurst Bridge
Rogue River @ Dodge Bridge
Little Butte Cr. @ Agate
Bear Cr. abv Ashland Cr. nr Ashland
Bear Cr. blw Ashland Cr. @ Valley View Rd.
Bear Creek @ Kirtland Rd.
Rogue River below Gold Hill
Applegate River NR Wilderville
Rogue River @ Robertson Bridge
Rogue River near Agness Ore.
Illinois River below Kerby
Donner und Blitzen River NR Frenchglen
Crater Lake NR Crater Lake Ore.
85-87
80-82
Legend
Beneficial Use Protected
Beneficial Use Generally Attained
Beneficial Use Threatened
Beneficial Use Impaired
Insufficient Data for Evaluation
No Data Collected

Figure 1.3(b)

Oregon Water Quality, Based on Region 10 Water Quality Index

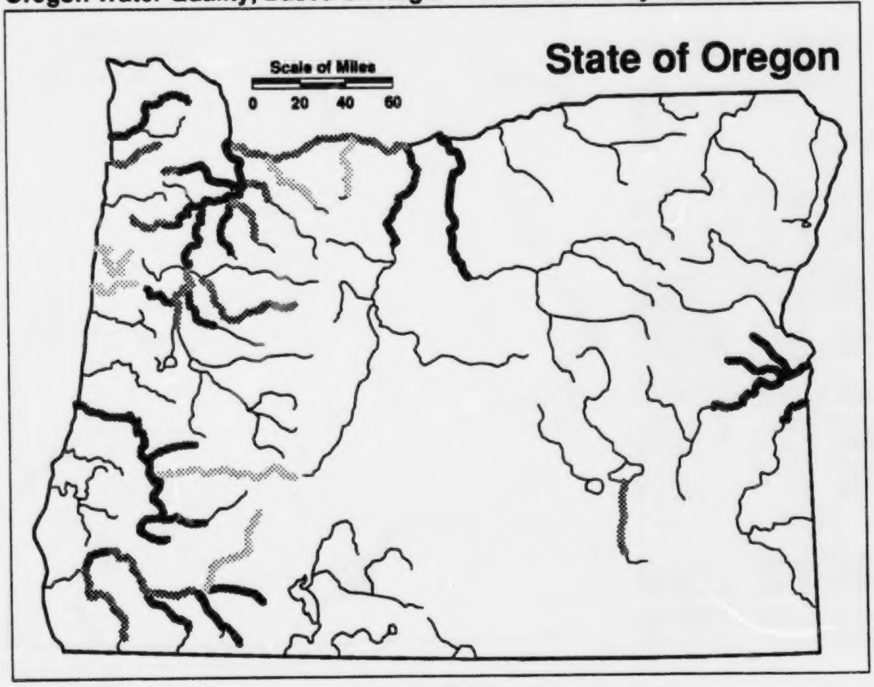
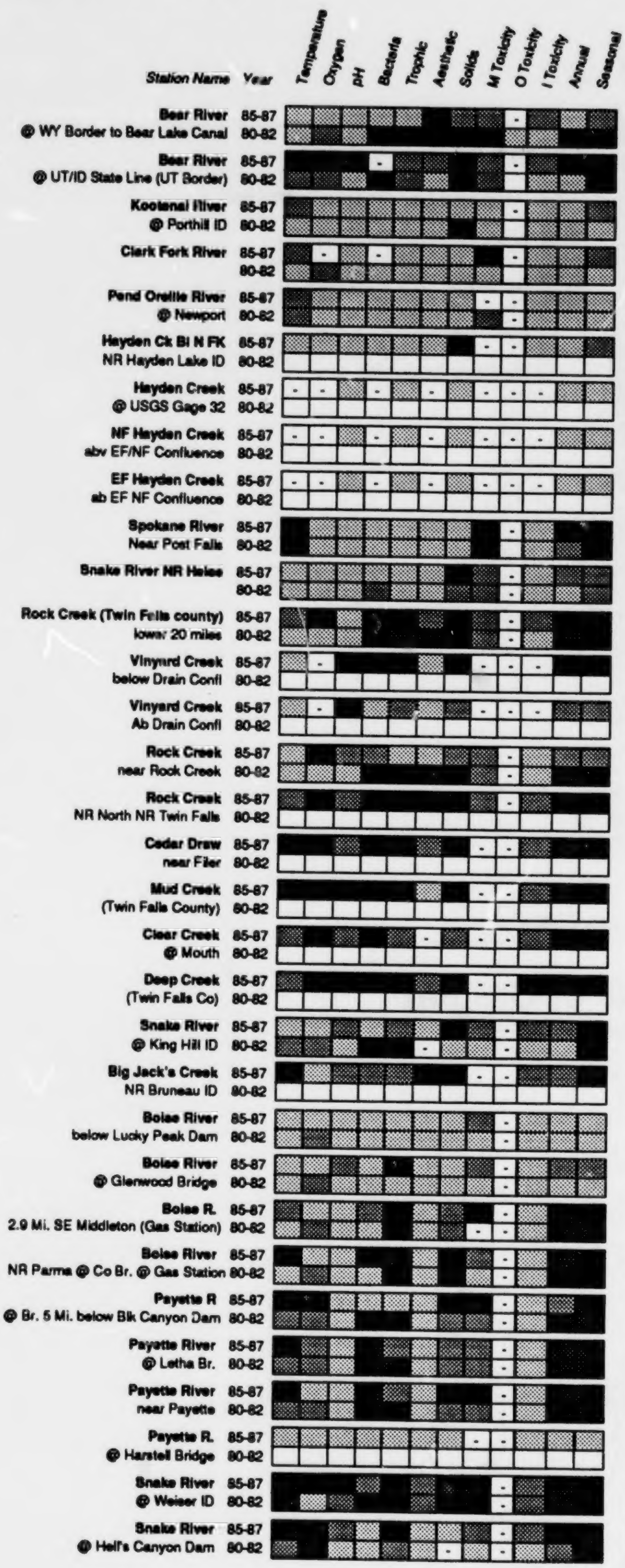
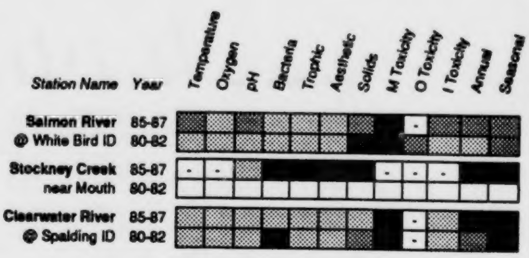

Scale of Miles
0
20
40
60
State of Oregon

Figure 1.4(a)
Water Quality Index Tables for the State of Idaho
Current Status and Trends


Temperature
Oxygen
pH
Bacteria
Trophic
Aesthetic
Solids
M Toxicity
O Toxicity
I Toxicity
Annual
Seasonal

Station Name	Year
Bear River @ WY Border to Bear Lake Canal	85-87 80-82
Bear River @ UT/ID State Line (UT Border)	85-87 80-82
Kootenai River @ Porthill ID	85-87 80-82
Clark Fork River	85-87 80-82
Pend Oreille River @ Newport	85-87 80-82
Hayden Ck Bl N FK NR Hayden Lake ID	85-87 80-82
Hayden Creek @ USGS Gage 32	85-87 80-82
NF Hayden Creek abv EF/NF Confluence	85-87 80-82
EF Hayden Creek ab EF NF Confluence	85-87 80-82
Spokane River Near Post Falls	85-87 80-82
Snake River NR Heise	85-87 80-82
Rock Creek (Twin Falls county) lower 20 miles	85-87 80-82
Vinyard Creek below Drain Confl	85-87 80-82
Vinyard Creek Ab Drain Confl	85-87 80-82
Rock Creek near Rock Creek	85-87 80-82
Rock Creek NR North NR Twin Falls	85-87 80-82
Cedar Draw near Filer	85-87 80-82
Mud Creek (Twin Falls County)	85-87 80-82
Clear Creek @ Mouth	85-87 80-82
Deep Creek (Twin Falls Co)	85-87 80-82
Snake River @ King Hill ID	85-87 80-82
Big Jack's Creek NR Bruneau ID	85-87 80-82
Boise River below Lucky Peak Dam	85-87 80-82
Boise River @ Glenwood Bridge	85-87 80-82
Boise R. 2.9 Mi. SE Middleton (Gas Station)	85-87 80-82
Boise River NR Parma @ Co Br. @ Gas Station	85-87 80-82
Payette R @ Br. 5 Mi. below Blk Canyon Dam	85-87 80-82
Payette River @ Letha Br.	85-87 80-82
Payette River near Payette	85-87 80-82
Payette R. @ Harstell Bridge	85-87 80-82
Snake River @ Weiser ID	85-87 80-82
Snake River @ Hell's Canyon Dam	85-87 80-82

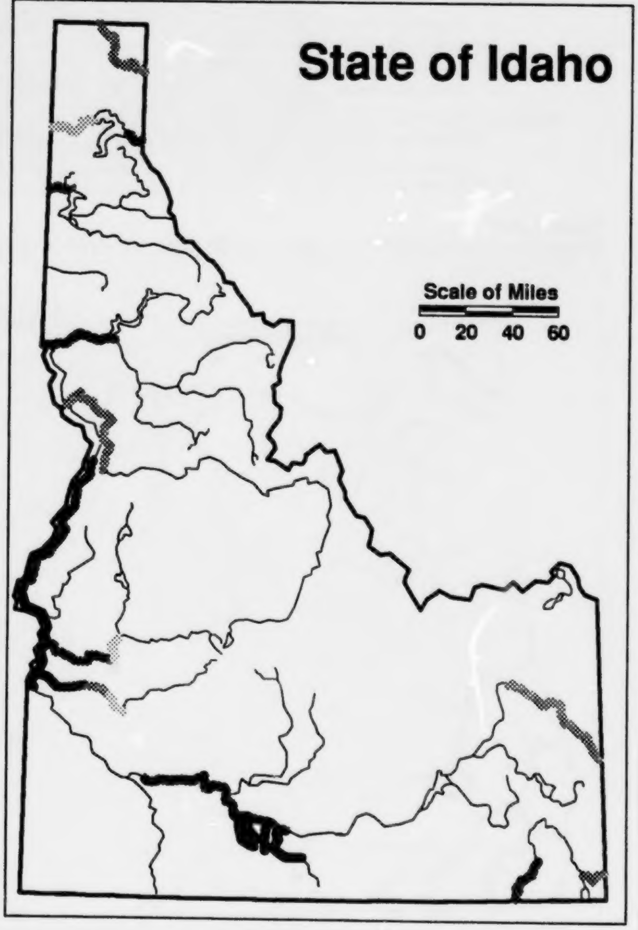


Station Name	Year
Salmon River @ White Bird ID	85-87 80-82
Stockney Creek near Mouth	85-87 80-82
Clearwater River @ Spalding ID	85-87 80-82

Legend

░	Beneficial Use Protected
▒	Beneficial Use Generally Attained
▓	Beneficial Use Threatened
█	Beneficial Use Impaired
-	Insufficient Data for Evaluation
☐	No Data Collected

Figure 1.4(b)
Idaho Water Quality, Based on Region 10 Water Quality Index



have high river water quality, with 72% of the streams evaluated having uses which are classed as protected or generally attained. In Oregon, by contrast, 52% of the waters evaluated were classed as having threatened or impaired uses. This may reflect the location of river water quality sampling stations, however, rather than actual trends in water quality, as Oregon's river sampling stations tend to be concentrated in areas subject to possible adverse effects from pollution. Idaho provides a more extreme example of this. Because the state has such a limited water monitoring program, water quality sampling has tended to focus almost exclusively on areas with known water quality problems. Thus Idaho's monitoring program is of minimal value in assessing water quality trends in the state as a whole.

Limitations

While the WQI appears to be a useful tool for measuring water quality status and trends, there are three major limitations to its use. First, the time and resources needed to compute the index make it impractical to calculate for all water segments. Therefore, it will be necessary to use the index only on "indicator" segments. This is not a major concern, as long as the index is calculated for segments of exceptional ecological value, segments which have recognized pollution problems (e.g., water quality-limited segments), and segments which are representative of those not in either category above.

The second limitation is that the index primarily focuses on water quality criteria, which tend to reflect water column measures. The index thus does not consider habitat condition (for example, the suitability of a stream reach for salmonid spawning or rearing). This limitation could be overcome by using the WQI in association with a habitat condition index. While no generally accepted habitat condition index exists, the OWP will continue to explore this possibility through contact with fishery resource agencies. It is anticipated that considerable progress will be made in developing such an index in the coming years as habitat monitoring requirements are set and data becomes available as a result of the Timber/Fish/Wildlife project in Washington.

The third limitation is that the general public has no intuitive understanding of the WQI. This creates difficulty in its use as a means of conveying to the public the nature and extent of water quality problems. This drawback can be partially overcome by using the WQI in association with other indicators with which the public can more readily identify.

7. Pacific Northwest Rivers Study

As discussed earlier, the database of resident resources, wildlife resources, natural features, cultural features, and fish recreational resources developed by the Bonneville Power Administration (BPA) for Pacific Northwest rivers and streams has not been updated significantly during the past year. Thus this indicator (actually a set of indicators) will not be discussed in detail. An additional database was developed to indicate which Pacific Northwest rivers and streams are used by anadromous fish. This data does not involve an assessment of the value of the fishery for each stream, as was done earlier for resident fish and wildlife. However, the database should be useful in the long-term to illustrate any dramatic changes in spawning areas.

The database developed by BPA was a critical tool used to generate a proposed listing of "designated protected areas in the Pacific Northwest." The purpose behind the proposal was to identify areas of critical importance to fish and wildlife, and subsequently use this data to guide development of hydroelectric facilities in the Northwest. Conversely, the proposal would also facilitate construction of hydropower projects by identifying areas where fish and wildlife concerns would present serious threats to future development. The result of this effort will hopefully be to allow hydropower projects to proceed without divisive, time consuming, and costly controversy.

The adopted protected areas proposal is now a formal amendment to the Northwest Power Planning Council's (NPPC) Columbia River Basin Fish and Wildlife Program and the Northwest Power Plan. While the NPPC does not license hydroelectric development, both the BPA and the Federal Energy Regulatory Commission are legally obligated to take the NPPC's action (adoption of the protected areas) into account in their decision-making. The NPPC's single standard is that no new hydroelectric development should occur in the protected areas. Approximately 44,000 miles of rivers and streams in Washington, Oregon, Idaho, and Montana are affected by the designations. This represents about 20% of the total stream/river miles assessed by BPA in the four states.

Basin Pilot Projects

Three pilot river basins were evaluated in last year's report on environmental indicators. The basins evaluated were the Yakima, Tualatin, and Chehalis River basins. These basins were chosen because intensive water quality studies were (and still are) underway in each. The studies were all designed with different purposes in mind, and focus on widely differing environmental problems.

Chapter 1: Surface Water

The objective of the basin pilot projects was to identify potential indicators specific to certain types of pollution problems. These indicators would not necessarily be valuable when applied to the Region or a state as a whole, but might be the best parameters to track in terms of observing the results of pollution control efforts in a particular waterbody (whether that waterbody is an entire estuary, a small embayment, a river basin, a stream reach, etc.).

Selection of the parameters to evaluate involved the identification of "environmental indicators" which best reflect the impacts of the specific water quality problems in each basin. In defining the indicators to be used, we attempted to focus on those factors limiting the full attainment of beneficial uses. This "limiting factor" approach will provide the focus for future development of environmental indicators as more information becomes available from each of the basin studies.

1. Yakima River Basin

The water quality of the Yakima River basin is being studied by the U.S. Geological Survey (USGS) as a pilot effort for the agency's proposed National Water Quality Assessment Program. As such, the effort provides an excellent opportunity for a case study of how environmental indicators might be developed on a basin-wide basis. The study is intended to be a prototype for how USGS would propose to sample surface waters to assess their water quality status and long-term trends. USGS has developed a multi-agency liaison committee to oversee study design and sampling progress. Representation on the liaison committee has been the vehicle for other agencies/interest groups to identify their management information needs for USGS. USGS has responded to the liaison committee by significantly modifying their sampling effort to accommodate the information needs of these other agencies.

The indicators evaluated in the Yakima basin in the past included the number of salmonid smolts produced in the basin, temperature and nutrient concentrations in the mainstem Yakima River, and concentrations of toxic pollutants in river sediments and fish tissues. Little new information on these indicators is available since last year, although U.S.G.S. has collected new information (e.g., concentrations of pesticides in the waters of the Yakima River and its tributaries which exceed EPA's water quality criteria) which corroborates the information assembled earlier. In addition, an intensive synoptic survey confirmed what was generally already known; that bacteria do reach concentrations which impair the recreational use of the Yakima River, particularly at Granger and Grandview. The elevated bacterial levels result from extremely high concentrations in certain irrigation return flows and tributaries which pass through areas of intense agriculture.

The agencies and interest groups participating on the liaison committee are largely united in their belief that water quality in the Yakima basin which fully supports aquatic life and recreational uses is an attainable and worthwhile goal. However, conflicts over the use of water resources, particularly the increasing demand for a consistent supply of water for irrigation, have led to serious polarization among the Yakima's user groups. The influence of irrigation return flows on Yakima River water quality, and the effect of irrigation water diversions on water quantity, are obvious.

Also obvious are many of the actions needed to improve water quality. Examples are:

- tighter controls on the use of pesticides near surface waters;
- protection of streambanks and riparian vegetation from grazing livestock; and
- reductions in the volume of irrigation return flows through more efficient water delivery systems.

The difficulties lie primarily in implementing or expediting these actions, given the polarization of the various user groups. This is a common, yet unfortunate, situation, since many of the actions which will improve water quality will also improve conditions for competing user groups as well. Thus education is a key component in improving water quality conditions in the Yakima basin.

2. Chehalis River Basin/Grays Harbor Estuary

Recent studies have shown that juvenile coho salmon migrating to sea via the Chehalis River/Grays Harbor in Washington State only survive to adulthood at half the rate as juvenile coho salmon from other coastal rivers. The loss to the commercial and recreational fishery is estimated at one million dollars per year. Although not quantified, the impacts to the chinook salmon and steelhead trout fisheries are believed to be greater. This resource loss represents one of the major environmental problems faced by Region 10.

The initial information which documented the salmon survival problem was based upon the rates at which fish from the Chehalis River basin and an adjacent, undeveloped river basin (the Humptulips River basin) are caught in the ocean fishery. This was determined by tagging outmigrating smolts from both river basins, and later recovering tags from the ocean fishery catch. The Humptulips River, which flows into the outer, unpolluted portion of Grays Harbor, provides a suitable control site. If the mortality problem in Chehalis River coho salmon is due to anthropogenic effects, the rate at which fish are caught in the ocean fishery will be a valuable environmental indicator of relative survival, and will be useful in tracking positive effects of any future management actions to control pollution sources (Figures 1.5-1.6). The management goal for this indicator would be to produce comparable survival rates in fish emanating from the two basins, unless the reduced survival is found to result from natural or uncontrollable conditions.

Figure 1.5
Relative survival of hatchery coho salmon from the Chehalis River (Simpson) hatchery and the Humptulips River hatchery, 1980-1984, as indicated by the percentage of tagged fish caught in the ocean fishery

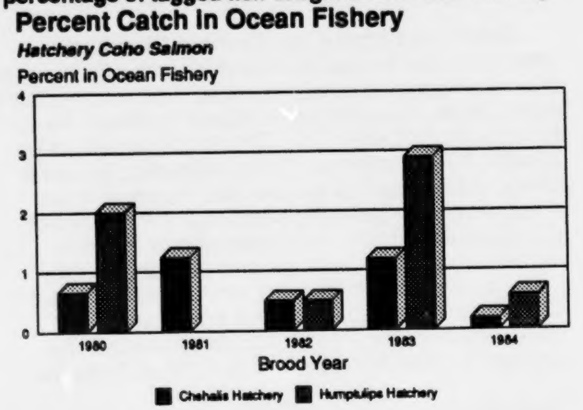
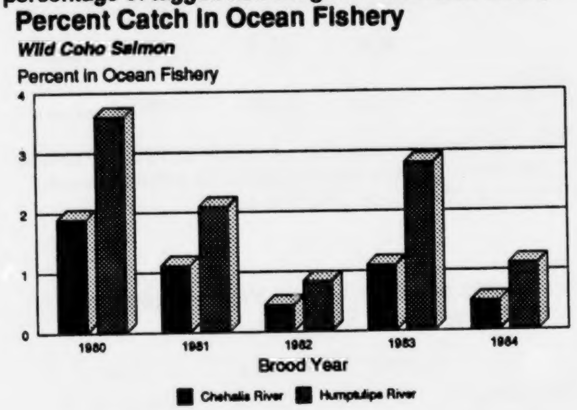


Figure 1.6
Relative survival of wild coho salmon from the Chehalis and Humptulips Rivers, 1980-1984, as indicated by the percentage of tagged fish caught in the ocean fishery



Local, state, and federal agencies joined together with industry, tribal groups, and others to support efforts to identify the cause of the reduced salmon survival. An initial pilot study of the nature of the problem was conducted during 1987. The Washington State Legislature followed up that effort by providing $400,000 for a comprehensive two year study of the problem, which began in 1988. In addition, other state and federal agencies, including EPA Region 10, provided both monetary and technical support for complementary studies, such as the identification and characterization of point and nonpoint source discharges to the harbor, effluent bioassays on smolting coho salmon, ambient water quality sampling in conjunction with the fishery studies, and analytical and lab support. These efforts supplement the Washington Department of Fisheries studies which include (1) evaluations of smolt status and health as fish migrate down the Chehalis and Humptulips Rivers and enter Grays Harbor; (2) coho migration rates and patterns at the head of the estuary; (3) effects of squawfish predation; and (4) effects of river and harbor waters on smolting coho when downstream migration pathways and rates are controlled (this was accomplished by moving fish downstream in pens located on mobile barges).

The pilot studies conducted during 1987 indicated that Na-ATPase levels in fish migrating downstream from the Chehalis River become depressed upon reaching inner Grays Harbor (Figures 1.7-1.8).

Figure 1.7
Sodium ATP-ase levels in coho salmon from the Chehalis River basin through inner Grays Harbor, May 1987. Stations sampled were Still Tr = Stillman Creek, Main Chehalis = mainstem Chehalis River at RM 35, Cow/Ren = Cow Point/Rennie Island, Moon Is = Moon Island, and S. Channel = South Channel

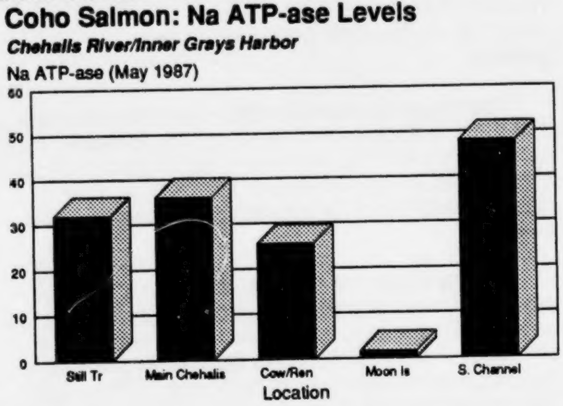
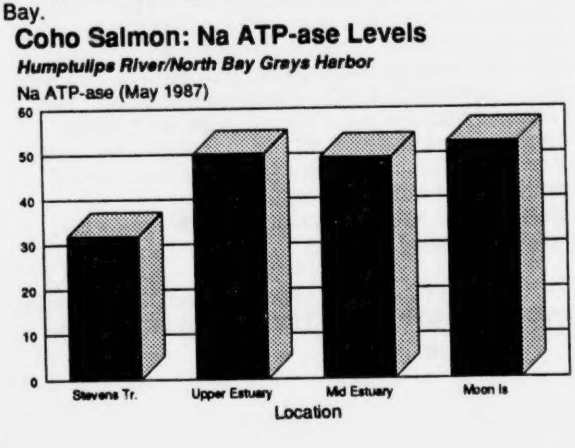


Figure 1.8
Sodium ATP-ase levels in coho salmon migrating from the Humptulips River basin through North Bay of Grays Harbor, May 1987. Station locations were at Stevens Creek, and in the upper, middle, and lower portions of North Bay.



Normally, Na-ATPase levels increase as juveniles prepare to migrate downstream, and continue to rise as the smolts migrate into and through estuaries. Fish migrating down the Humptulips River show this typical pattern. Fish migrating down the Chehalis River, however, show a significant depression in Na-ATPase when they reach the head of the estuary (at Cow Point/Rennie Island). Levels then begin to rise again as the fish continue to move farther out into the estuary. Na-ATPase levels are known to be sensitive to certain pollutants, such as chlorinated phenols and copper, which are present in Grays Harbor. Lowered Na-ATPase levels would be expected to reduce the ability of smolts to adjust to seawater. Physiological effects associated with lowered levels include decreased liver function, increased red blood cell fragility, increased reticulocyte counts, and decreased energy levels. Na-ATPase levels may thus be a sensitive indicator of pollution control efforts.

Although results of the 1988 studies have not been compiled into any type of report, the results indicated that a similar trend was seen. However, the pattern was not as pronounced as it was in 1987. It is believed that this was a result of sampling smolts after the peak smolting period, when fish would tend to be somewhat less sensitive to stress. The timing of sampling during 1989 will be modified to correct this problem.

The major concern with the use of this indicator is that there is not presently an established relationship between Na-ATPase levels and decreased survival of smolts. Hopefully, this relationship will be more closely established (or refuted) during the two-year study.

The results of the 1988 studies also show that other measures of stress in coho salmon support the belief that fish exposed to inner harbor waters are stressed. For example, coho salmon removed from the barge pens after exposure to inner harbor water had reduced levels of cortisol in their blood at a time when the natural stress of smolting produces high cortisol levels. It appears that the fish were unable to respond in a normal fashion to the stress of entering brackish water. At the same time, the immune systems of the fish were depressed. Of particular concern was that fish removed from the barges after exposure to inner harbor water and transported to saltwater pens at Manchester suffered 80% mortality when exposed to a natural outbreak of *Vibrio*. Fish removed from the pens but not exposed to inner harbor waters suffered only 20% mortality during the *Vibrio* outbreak. This last event may have helped establish the vital link sought between the physiological stresses measured in this study and reduced survival.

Results of the water chemistry sampling likewise are not available in report form. However, the raw data does show that dioxin was detected in the inner harbor in levels exceeding EPA's water quality criterion. Concentrations in the South Channel, near the Weyerhaeuser Co. Pulp Mill outfall were 7 times the criterion, while concentrations in the North Channel near the ITT Rayonier Pulp Mill outfall were 1.6 times the criterion. Sampling of suspended sediments in the effluent of the two pulp mills show dioxin was detected in the Weyerhaeuser Co. effluent, but not ITT Rayonier's effluent. This corresponds well with sampling of dioxin in the tissue of fish collected below the outfalls of the two mills; dioxin was detected in fish tissue below the Weyerhaeuser Co. outfall, but not in fish tissue below the ITT Rayonier outfall.

Smolt production in the Chehalis River basin should also be a valuable indicator of the effectiveness of environmental control programs. This information is available for the upper basin (above the Black River) for four years (Table 1.10). This indicator will not be affected by any pollution controls affecting the lower Chehalis River and Grays Harbor. However, it will reflect any changes in the production capabilities of the upper watershed. Estimates of coho salmon escapement to the basin are also included as they help explain variation in smolt production (Table 1.11). The management goal for smolt production in the upper Chehalis River basin should be to reach the estimated production potential of 1,000,000 smolts.

Table 1.10

Coho salmon smolt production in the upper Chehalis River Basin (upstream of the Black River). Estimated production potential is 1,000,000 smolts.

	1976	1977	1986	1987
Smolt Production	116,000	47,000	700,000	*400,000

*Due to the low escapement of fish in 1985, and thus a low production of eggs, 3,000,000 coho fry were planted in the upper Chehalis basin.

Table 1.11

Estimates of recent coho salmon escapement to the Chehalis River Basin

	1984	1985	1986
Escapement	110,000	10,000	6,000-35,000

3. Tualatin River Basin

The Tualatin River serves as an important resource to a growing population. Industries use the river for manufacturing. Farmers use the river for crop irrigation. Anglers and boaters use the river for recreation. The Tualatin provides drinking water to Forest Grove, Hillsboro, and Beaverton. These uses depend on good water quality.

The Tualatin's water quality, however, has been an on-going concern. Low dissolved oxygen caused by ammonia discharges from sewage treatment plants threatens aquatic life. Heavy algae growth in the slow-moving river is "fed" by nutrients, such as fertilizers, and discourages recreational use. There is also a concern about toxics in the river as new industry moves into the area.

Population in the Tualatin River basin has increased dramatically in recent years from 60,000 in 1950 to 250,000 today. Population is projected to reach 350,000 by the year 2000. Without taking significant actions to reduce pollution in the basin, the population growth alone will cause further degradation of water quality. The indicators chosen last year in the Tualatin River track known pollution problems. While a number of management actions have been taken in the past to reduce pollutant loadings, problems still remain. New indicators will probably be developed in the future, as new problems become evident. A current study by the Oregon Department of Environmental Quality includes collection of sediment and fish tissue samples for analysis of toxic pollutants. Since the large population growth anticipated is likely to result in increased loading of toxics to the river, it would seem prudent to add the baseline levels of toxics as an additional indicator, once this information is available.

The parameters previously chosen for use as indicators in the Tualatin River Basin were dissolved oxygen and nutrients. This stems from the belief that the factors limiting growth of aquatic life and recreational use in the river are discharges of substances which lower dissolved oxygen and excessive nutrients which cause algal blooms. The information gathered on these parameters during the past two years was used as the basis for calculating the allowable loading capacity for these pollutants such that state water quality standards are expected to be achieved. The allowable loading limits have been used to set more stringent discharge limits for the major point source dischargers to the river. After implementation of the more stringent limits, it should be possible to track improvements in dissolved oxygen and nutrient levels in the river.

Future improvement of Tualatin River water quality, however, is dependent upon the assumption that human discharges of oxygen-consuming wastes and nutrients were limiting aquatic life and recreational use in the river. There are some who feel that the slow-moving, almost lake-like character of the lower reaches of the Tualatin River inherently limits water quality in the river. While it appears that the decisions have been made and accepted to move towards expensive point source controls, it is possible that the resulting improvements in water quality may be limited.

Surface Water Environmental Indicators
FY 89 and Beyond

Ongoing Activities. The activities listed below are continued from previous years. Information will be included as appropriate and as new data become available.

1. **Summary of waters fully, partially or not supporting uses**
2. **Waterbody Tracking System (WBS) information:**
    a. Water quality limited (WQL) status
    b. Limiting pollutants from WQL segments
    c. Pertinent dischargers to WQL segments
    d. WQL segments where all needed water quality-based controls have been implemented
3. **NPDES permitting information:**
    a. Number/percent of permits with biomonitoring requirements
    b. Number of water quality-based permits issued
    c. Number of water quality-based permits with toxics limits
    d. Total loading limits for toxics
4. **Results of northern Idaho aerial lakeshore analysis**
5. **Water Quality Index**
6. **Status of classified shellfish areas**
7. **Basin pilot projects for Tualatin, Yakima and Chehalis Rivers**

Surface Water Environmental Indicators FY 89 and Beyond (Continued)

New Initiatives. The Water Division has several promising new initiatives underway that should provide valuable new information on the health of Region 10's environment. This information will be included as results permit:

1. ***Aquatic Resources Conference***. Washington will hold their first annual conference this fall to discuss the health of the state's aquatic resources. This conference, a result of EPA's push for "State Clean Water Strategies", will be an in-depth review of the status, trends, and problems confronting those resources.
2. ***Citizen's Stream-Walk Monitoring Program***. We are currently developing a standardized checklist and database to assist citizen volunteer groups in collecting useful information on their neighborhood waters. This information could then be aggregated on a regional basis. Field tests are now underway. Preliminary results are expected by early fall.
3. ***Science Teachers Coalition for a Sound Environment***. We are currently exploring ways to effectively integrate environmental monitoring into the science curriculums of both high schools and community colleges. A state-wide conference with Washington's science teachers on this issue will be held on October 6, 1989.
4. ***Critical Habitat Protection with the Northwest Power Planning Council***. The Council has identified critical salmon spawning and rearing habitat that needs protection. We are working jointly with the Council and our state NPS program managers to set protection goals and measures of progress.
5. ***Reduced Discharge of Excessive Chlorine.*** The Water Division Permits and Compliance Branch has agreed to review the procedures for developing an environmental indicator showing the reduced discharges of excessive chlorine from sewage treatment plants. Reducing discharge of excessive chlorine often involves modifying the chlorine feed system so it can operate on a flow-proportional basis. This is usually done in response to a change in the NPDES discharge permit and occasionally involves an EPA construction grant. This potential measure will be addressed in the next environmental indicators report.
6. ***Photographic Documentation.*** Whenever possible, an effort will be made to develop photographic files which depict--preferably with before, during, and after photos--environmental "stories" of degradation and/or improvements.

Chapter 2: Puget Sound

Puget Sound Environmental Indicators
FY 88

1. **Sediment Indicators**
    - Sediment Chemistry
    - Sediment Bioassays
    - Benthic Community Analyses

2. **Water Column Indicators**
    - Dissolved Oxygen
    - Turbidity
    - Nutrients
    - Chlorophyll
    - Pathogen Indicators

3. **Biological Indicators**
    - Fish Abundance
    - Chemicals in Fish Tissue
    - Fish Disease
    - Shellfish Abundance
    - Chemicals in Shellfish Tissue
    - Bacteria in Shellfish

4. **Habitat Indicators**
    - Wetland/Habitat Quality and Quantity
    - Wetland Mitigation Success

5. **Short-Term Toxics Control Indicators**
    - Effluent and Near-Source Ambient Biomonitoring
    - NPDES Contaminant Loading

Environmental Quality: Problem Statement

The quality of Puget Sound is a gauge of our success in environmental protection. Programs to control and prevent water pollution, protect marine fish and shellfish, and minimize risks to public health have long been in place in the region. As a result, substantial progress has been made toward controlling the discharges of many conventional pollutants, and much of the estuary remains relatively healthy and capable of supporting a broad range of beneficial uses. However, continuing urban growth and development are imposing ever-increasing demands upon the Sound. There is growing evidence that serious water quality-related problems remain.

Chemical Contamination: During the past few years, high concentrations of priority pollutants and other potentially harmful chemicals have been identified in the sediments of a number of urban/industrial bays in Puget Sound. Relatively little is known about the ways in which exposure to specific chemicals affect marine life; however, recent surveys have found alarming frequencies of tumors and other abnormalities in botton-dwelling fish and invertebrates in some areas. Data also indicate that significant levels of known carcinogens are accumulating in the tissue of marine birds and mammals. It has been unclear to what extent humans are at risk in consuming seafoods harvested from Puget Sound.

Bacterial Contamination: In recent years, the ability to grow and harvest shellfish in Puget Sound has also been increasingly affected by water quality problems. Although recreational harvesting is still allowed, the entire eastern shore of the estuary has been classified as uncertifiable for commercial shellfish harvesting due to the risk of high levels of coliform bacteria and toxic chemicals in the water. While the coliform bacteria are generally harmless, they indicate the potential presence of viruses and other harmful pathogens.

Habitat Loss and Degradation: The loss and degradation of valuable habitat, including wetlands and fish nursery areas, has occurred over the past

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several decades in the Puget Sound region at an alarming rate. The full impact of this loss on the biological productivity and stability of the estuary is not known, although experiences in other parts of the nation indicate that adverse impacts may be substantial.

Background: The Puget Sound Estuary Program

As mandated in the Clean Water Act, the primary function of the Puget Sound Estuary Program (PSEP) is to characterize past and current environmental conditions, facilitate development of a comprehensive management strategy to address current pollution-related problems, and facilitate development of a long term, Sound-wide monitoring program. In response to this mandate, PSEP has sponsored a wide range of studies since 1985. The results of these studies have added to our ability to characterize current environmental conditions in Puget Sound, and to understand the nature, extent, and significance of pollution impacts on estuarine resources. In addition, these studies provided the basis for a variety of the recommendations contained in the Puget Sound Water Quality Authority's (PSWQA) 1988 State of the Sound Report and the PSWQA 1989 Puget Sound Water Quality Management Plan.

The lead agencies in the Puget Sound Estuary Program are EPA (Region 10), the Puget Sound Water Quality Authority, and the Washington Department of Ecology. Region 10's Office of Puget Sound (OPS) has taken the lead in the area of funding (or occasionally conducting) technical studies which have been determined to be essential for improving our understanding and management of the Sound. OPS completes these technical studies through contracts with consulting firms or formal grant agreements with federal, state, and local agencies. Occasionally OPS works with the Region 10 Environmental Services Division to collect and analyze samples. Finally OPS acts as a clearinghouse for varying types of technical information, disseminating the results of specific studies to interested parties as a means of assuring that the various agencies working on similar issues or problems are addressing them in a coordinated, efficient, and scientifically acceptable manner.

Many of the projects funded by OPS generate information that can be used as "environmental indicators" of conditions, or trends, in the Puget Sound estuary. The OPS also works to: (1) assure that the environmental information gathered by different agencies or scientists is of a consistent, high quality; and (2) increase the usefulness of environmental information being collected by allowing it to be put into perspective with past or ongoing work in Puget Sound.

Office of Puget Sound - Status of Environmental Indicators in FY88

This section discusses the environmental indicators which were evaluated through projects initiated or completed for the Office of Puget Sound in FY88. Additional Puget Sound environmental studies are being conducted by other local, state and federal agencies. The conclusions (or in some cases the status) of these OPS projects are summarized below.

1. Sediment Indicators

Many toxic chemicals in Puget Sound adhere to particulate matter and settle to the bottom of the Sound. These chemicals may harm populations of bottom dwelling organisms by direct toxicity or by leading to altered mobility, physical or behavioral changes, or reproductive impairment. In addition, chemicals in the sediments may bioaccumulate in fish or shellfish tissue, thus causing potential health concerns for the seafood consumer. Sediment indicators most often measured in Puget Sound include sediment chemical concentrations, sediment bioassays, and benthic community analyses. OPS FY88 sediment-related environmental indicator projects included the following:

FY88 Puget Sound Reconnaissance Survey. This was a "one-time" survey to collect environmental information from several potentially contaminated locations in Puget Sound. Sediment samples were collected from six stations in each of four non-urbanized bays: Gig Harbor, Dyes Inlet, Port Angeles, and Oak Harbor. The harbors had generally restricted or reduced circulation, large marinas and some light industrial activity (fuel docks, boat building and repair facilities, etc.). Amphipod sediment bioassays conducted with the collected sediments showed low amphipod mortality. Sediment chemistry values were often above Puget Sound background levels but well below levels found in more urbanized areas like Elliott Bay. Since the bioassay and chemical analysis results did not indicate sediment related problems, benthic community analyses were not conducted.

Assessment of Potential Toxic Problems in Non-Urban Areas of Puget Sound – Literature Review. A review of past scientific literature and agency reports, as well as discussions with "old timers" familiar with past activities and conditions in Puget Sound, formed the basis of this report. The goal was to identify non-urbanized areas of Puget Sound where environmental problems might exist and where future reconnaissance surveys or other investigative activities might be warranted. The report indicates that of 97 areas evaluated, 7 were deemed potential areas of high concern, while 43 and 47 were considered to be areas of medium and low concern, respectively.

2. Water Column Indicators

The condition of water bodies is often evaluated by measuring specific water quality parameters including toxic chemicals, nutrients, temperature, dissolved oxygen, or others depending on the water quality problems of interest. Previous water column measurements of toxic chemicals in Puget Sound have repeatedly yielded low or undetectable levels (sulfite waste liquor appears to be the exception, although concentrations have decreased dramatically in the past 20 years). However, eutrophication concerns (and occasional problems) in the Sound have been the basis for the collection of a considerable database of eutrophication-related parameters (dissolved oxygen, nutrients, turbidity). Finally, a considerable database also exists for the concentration of bacterial indicator organisms (fecal coliform bacteria--which indicate the probable presence of human pathogens in the water) in the Sound. Work the OPS funded on water column indicators is outlined below.

Characterization of Spatial and Temporal Trends in Water Quality in Puget Sound. The primary purpose of this study was to determine whether water quality in Puget Sound has changed over time. Oceanographic data over the past 50 years (although most Puget Sound data sets begin in the 1950's) were obtained from the University of Washington School of Oceanography, the Washington Department of Ecology, the Washington Department of Fisheries, and the Municipality of Metropolitan Seattle. Long-term data were only available from 12 areas in Puget Sound (see Figure 2.1).

Results

Dissolved oxygen (D.O.) concentrations have increased or remained unchanged in all areas except Point Jefferson. This apparent decline at Point Jefferson appears to have been caused by some high values recorded from the mid-1970s, and by erratic variations that have occurred since the mid-1970s, including some low values in 1986.

Phosphate - There have been recent increases in urban areas, and no changes in rural areas. The significance of these small increases is unknown.

Nitrates - No trends were apparent.

Sulfite Waste Liquor - Decreases in all areas.

Fecal Coliform Bacteria - No change or a decrease in bacterial concentrations were observed in any areas except Everett Harbor. This increase in Everett appears to be associated with the initiation of secondary treatment by a local pulp mill and may represent an increase in the number of *Klebsiella* (an organism that is detected in standard tests for fecal coliform bacteria) released into the water with the secondary treatment process.

Turbidity and Chlorophyll - Measurements of these variables have been made very infrequently in Puget Sound in the past. Potential trends include reduced turbidity at Point Jefferson and Oakland Bay and increased turbidity in Carr Inlet. Probable increases in chlorophyll concentrations (indicating increases in phytoplankton abundance) were detected only in Carr Inlet and Hood Canal.

The above conclusions represent an enormous effort in gathering and compiling existing data, confirming the quality of those data, and carrying out tests to determine the significance of observed trends. However, even in the more heavily sampled areas, the amount of data available was limited and the conclusions should not be considered definitive. The absence of detectable changes in a study area may indicate that no changes in water quality occurred, or that the available data did not provide sufficient resolution to detect changes that did occur. The limitations of this study's conclusions reinforces the ongoing efforts of the Office of Puget Sound to initiate a long term monitoring program for Puget Sound. This program must incorporate the use of standard sampling and analytical protocols and generate consistently high quality data.

3. Biological Indicators

The organisms present in a body of water can indicate a great deal about the environmental quality of the water and the sediments below it. Biological indicators which are useful in Puget Sound include:

- the presence and absence of various "indicator" organisms (indicative of pristine or disturbed conditions);
- the composition of existing marine communities--abundance of economically important species;
- chemical levels in the tissues of marine species--disease conditions in various species;
- bacterial contamination levels in bivalve shellfish.

The FY 88 biological indicator-related projects funded by the Office of Puget Sound are described below.

Fish Abundance. A study was initiated by the Fisheries Research Institute at the University of Washington to evaluate existing fishery trawl data in an effort to characterize trends in the abundance, distribution, and prevalence of disease in marine fish from a number of areas in Puget Sound. A preliminary study in FY 87 identified the most comprehensive and long term data sets available for both commercial and

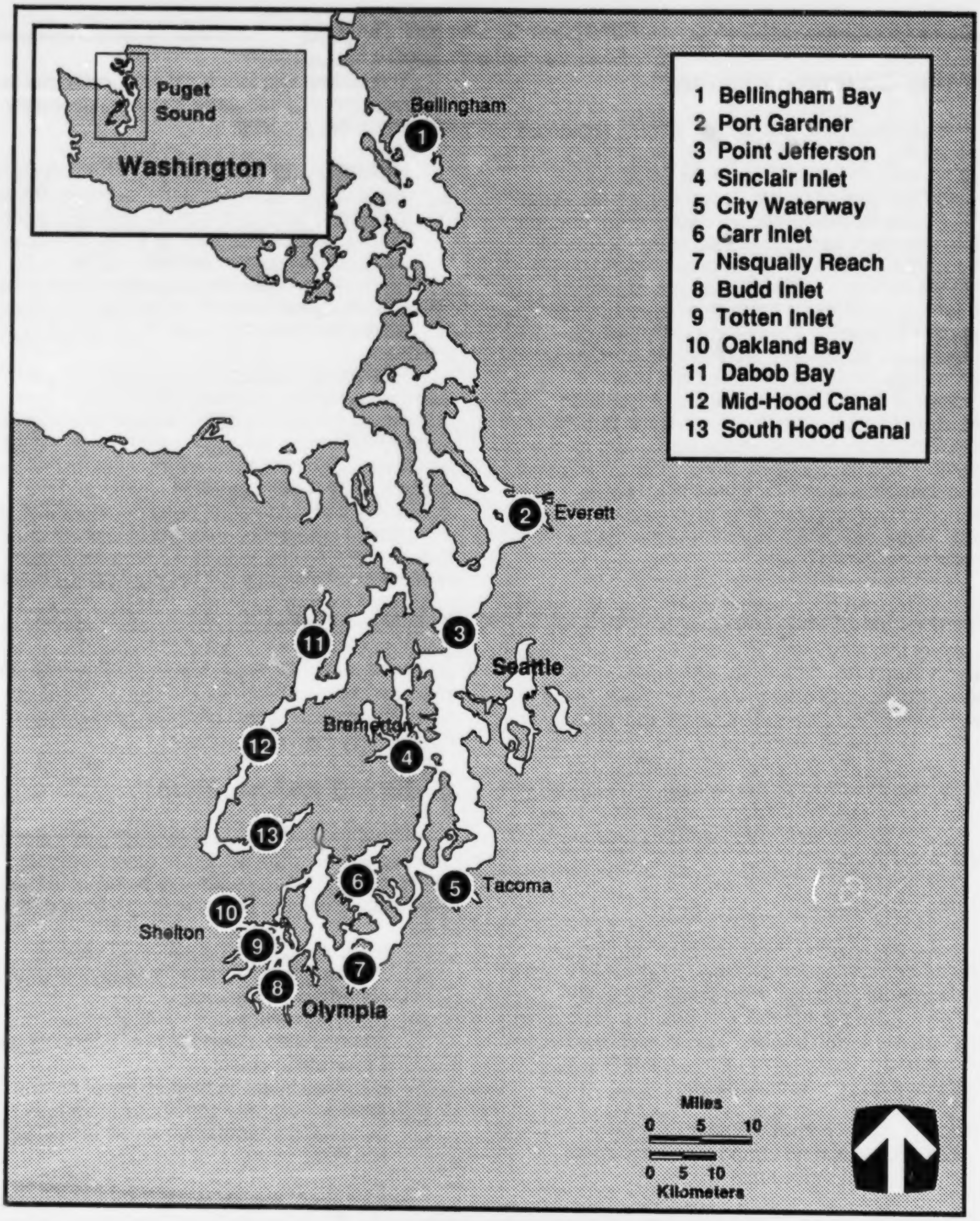
Puget Sound
Washington
Bellingham
Everett
Seattle
Bremerton
Tacoma
Shelton
Olympia
1
2
3
4
5
6
7
8
9
10
11
12
13
1 Bellingham Bay
2 Port Gardner
3 Point Jefferson
4 Sinclair Inlet
5 City Waterway
6 Carr Inlet
7 Nisqually Reach
8 Budd Inlet
9 Totten Inlet
10 Oakland Bay
11 Dabob Bay
12 Mid-Hood Canal
13 South Hood Canal
Miles
0 5 10
0 5 10
Kilometers

Figure 2.1

Map of Puget Sound Showing Locations of the Study Areas in the Water Quality Characterization Project

non-commercial species. A secondary objective of this study will be to establish a baseline record against which future fish monitoring efforts can be compared and evaluated. Such future monitoring has been included in the design of the Puget Sound Ambient Monitoring Program. A draft trend assessment is expected by mid 1989.

Chemical Contamination in Seafood and Associated Human Health Risks. During 1986-1988, concern over potential health risks associated with consumption of locally harvested seafood prompted OPS to undertake several studies of chemical contaminants in Puget Sound seafoods. Groundfish, salmon, shellfish, and edible seaweed were harvested from a variety of locations in the Sound and the tissue analyzed to determine the concentrations of PCBs, pesticides, other organic contaminants, and metals. Using this information, and an EPA risk assessment model, potential health risks associated with consumption of Puget Sound seafoods were calculated.

In summary, potential health risks associated with consumption of Puget Sound seafood are primarily attributable to PCB concentration in fishes, and PCBs and PAHs in shellfish and seaweed. For Puget Sound, potential health risks, exclusive of the contribution of PCBs, are within the generally acceptable range of 10^{-6} to 10^{-5}. However, with the inclusions of PCB-contaminated fish, the potential health risks may exceed 10^{-4} for certain locations in Puget Sound.

These elevated risk levels do not imply the existence of unique or pervasive chemical contamination in Puget Sound biota, but serve to indicate that portions of Puget Sound, like other U.S. coastal areas, are subject to the legacy of past uses and management of potentially toxic chemicals. Overall, the ranges of potential health risks associated with most of the chemical contaminants evaluated in Puget Sound seafood are comparable to or lower than those indicated in the literature for other U.S. coastal locations.

As part of the "recon survey" described elsewhere in this report, fish tissue samples were taken from several areas of the Sound which were previously unsampled. The results of this information will be available in the near future, and will serve to supplement the results of the current risk assessment study. The Puget Sound Ambient Monitoring Program will provide the vehicle for the evaluation of changes in fish and shellfish tissue contamination over the long term.

Fish Disease. Puget Sound Reconnaissance Survey

As part of the previously mentioned "recon survey", adult English sole were captured from three non-urbanized areas in the Sound where information on fish disease has never been collected (Gig Harbor, Dyes Inlet, and the mouth of the Lake Washington Ship Canal).

The prevalence of liver disease was evaluated for each site. The incidence of disease was very low (at Puget Sound background or reference levels) for fish from Dye's Inlet and Gig Harbor, although the Dye's Inlet fish were somewhat younger (and thus would be expected to have a lower incidence of disease) than fish from the other two sites. The fish from the Lake Washington Ship Canal had an incidence of liver disease which approached that found in some of Puget Sound's more industrialized areas.

Shellfish Abundance. Measurement of the abundance of bivalve shellfish will be part of the Puget Sound Ambient Monitoring Program and will begin in late 1989 if state funds are available.

Chemicals in Shellfish.

(1) Human Health Risk: See "Chemical Contamination in Seafood and Associated Human Health Risks" above.

(2) Trends in the Incidence of Paralytic Shellfish Poisoning (PSP) in Puget Sound Bivalve Shellfish: In FY88 the Office of Puget Sound provided funds to the Puget Sound Water Quality Authority and the Washington State Department of Social and Health Services to develop a database of the results of PSP monitoring over the past decade. This database and the resulting trends analysis will indicate whether the incidences of beach closures due to PSP outbreaks have been increasing or decreasing since monitoring began. Results of this project will be available in mid 1989.

Bacterial Contamination of Bivalve Shellfish. The Office of Puget Sound funded the Washington State Department of Social and Health Services to collect bivalve shellfish from Puget Sound and conduct chemical and bacteriological analyses of the shellfish. The final report of this project, ***Chemicals and Bacteriological Organisms in Recreational Shellfish***, indicated that clams from many Puget Sound recreational beaches fail the bacterial standard for commercial shellfish (there are no existing bacterial standards for regulating recreational harvesting and there is little existing monitoring of recreational shellfish beds). Table 2.1 indicates the percent of the samples from each of the beaches studied that exceeded the commercial shellfish standards of 230 fecal coliform bacteria per 100 grams of shellfish meat.

Table 2.1

Percentage of times bacterial counts in clams at each beach exceeded the regulatory limit (230 MPN) for closing commercial clam beds

Site	N	MPN Categories <30	30-230	>231
Birch Bay State Park	7	71%	29%	0%
Brownville	8	25	62	13
Burley Lagoon	7	29	29	42
Burton County Park	7	86	14	0
Camano Island State Park	7	71	29	0
Carkeek Park	5	20	60	20
Dash Point State Park	6	0	50	50
Dosewallips State Park	6	0	0	100
Lincoln Park	6	0	67	33
Mukilteo Fuel Tanks	7	14	57	29
Normandy Beach Park	7	29	57	14
Picnic Point County Park	7	14	43	43
Point Vashon	7	14	14	72
Post Pt./S. Terminal Park	7	29	14	57
Priest Point Park	13	50	37	
Ross Point Tidelands	7	14	43	43
Saltwater State Park	7	43	43	14
Skiff Point	7	57	14	29
South Alki Point	6	17	50	33
Walker Park	7	0	0	100

MPN = "Most probable number" of bacteria present

Increased monitoring of recreational shellfish beds is likely to indicate that many Puget Sound beaches have shellfish exceeding the "commercial" coliform bacterial limit. This type of monitoring is called for in the Puget Sound Water Quality Authority's Puget Sound Water Quality Management Plan, and the Puget Sound Ambient Monitoring Program.

Chemicals in Wildlife. The OPS entered into a cooperative agreement with the Washington Department of Wildlife to evaluate what is known about toxic chemicals in wildlife in the Puget Sound area. This agreement was designed as a literature search and analysis of the current information on levels of chemical contamination in higher wildlife species. The study also discusses the utility and feasibility of using wildlife as an indicator of the overall health of the Sound.

Recent studies indicate that chemical concentrations vary between some local populations of birds and marine mammals. Levels of some contaminants (i.e., PCBs and metals) were high enough in some populations to warrant concern for the long term health of the birds. Some other contaminants (i.e., PAHs) which are sometimes observed in high concentrations in plankton and invertebrates, were found at near background levels in some higher species. Some very recent Canadian research on a number of local great blue heron colonies has revealed that some residuals of chlorophenol, used in wood and paper processing, may be the cause of failed reproduction in active heron nests.

In summary, limited data on measured levels of pollutants in wildlife preclude any regional trends, but the potential appears to exist for detecting localized problems through intra-regional comparisons. Monitoring local population numbers and reproductive rates could provide a trigger for further studies on contaminant levels in wildlife tissue. Likely higher environmental exposures and higher sensitivities of wildlife species make such monitoring a potentially effective method for gauging human health risks. Depending on the conclusions and recommendations of the Department of Wildlife report, the state may include additional wildlife monitoring in the Puget Sound Ambient Monitoring Program.

4. Habitat Indicators

In recent years the value of various habitats has been recognized as critical to the well being of fish and wildlife. Wetland habitats are in short supply in glacier-carved Puget Sound and existing wetland areas are under severe pressure from urban/industrial development. The value of this declining resource is being better understood each year. The Office of Puget Sound has funded several studies which relate to changes in wetland quantity and quality.

Protocol: Quantifying Loss. As of 1988 there was no comprehensive and systematic method for tracking quantitative trends in wetland loss. A cooperative project with the Washington Department of Natural Resources and EPA's Environmental Monitoring Lab in Las Vegas was initiated to establish systematic methods for both obtaining and evaluating replicable, management-quality wetland inventories. High resolution digital and photographic remote sensing data was collected during August 1988, and will be analyzed using digital scanners and geographic information system technologies. This effort will provide baseline wetlands data for the Puget Sound Ambient Monitoring Program and will provide a pilot test for identifying the most cost effective techniques for monitoring changes in wetlands.

Wetlands Loss Trends. To assess pre-1988 trends in wetlands loss, a cooperative study with the University of Washington will compare portions of the 1988 baseline inventory to a number of historic habitat mapping and photographic records. The specific objective is to characterize the large scale changes that have already occurred in portions of our wetland and shallow water kelp and eelgrass habitats, and direct our attention to areas where the most substantial changes have occurred. A trends report is expected in mid 1989.

Protocol: Mitigation Monitoring. An additional cooperative study has been undertaken with the University of Washington and Region 10's Section 404 Program to establish a methodology for monitoring the success of individual wetland mitigation projects. Since wetland restoration is being increasingly relied upon to replace the permitted loss of wetland habitats, there is an urgent management need to develop specific measurements for monitoring the effectiveness of these efforts. The specific objective of this study is to identify those critical chemical, physical, and biological parameters which can be quantitatively measured and reflect both the natural functions and quality of various habitats.

5. Short Term Toxics Control Indicators

In concert with the long term Puget Sound Ambient Monitoring Program, which will begin on a limited scale in the spring of 1989, several efforts are under way to better understand and/or limit inputs of toxic chemicals to the Sound. The Office of Puget Sound is funding work designed to:

1. Quantify the loading of contaminants to a Puget Sound bay from atmospheric sources and put atmospheric loading into perspective with the inputs from other pollutant sources; and
2. Evaluate the utility and relative sensitivities of a variety of sediment bioassay test organisms which are being (or may be) used to assess sediment quality in the Sound. This work is described in the section of this report entitled, "Status of FY88 OPS Commitments--Evaluation of Sediment Bioassays".

In addition, the Office of Puget Sound is assisting the Washington Department of Ecology as they prepare the Permit Writer's Procedures Manual/ Monitoring Guidelines. Through the use of this manual, the monitoring required of NPDES permittees will be increased as both effluent and ambient biological and chemical monitoring will often be required.

Other Efforts

Photographic Documentation of Changes. A selection of historical photographic slides of Puget Sound was obtained through the University of Washington archives. These slides are available for documenting and characterizing the availability and use of Puget Sound's estuarine resources over the last hundred years. "Before and after" contrasts depict extreme changes in estuarine wetlands, tidal flats, and riparian habitats. Seeing the historical phases of shoreline industrial development provides insight in interpreting the current status of Puget Sound. The collection has been used in two "advanced wetland identification" projects.

Increasing the Utility/Usefulness of Environmental Indicators. The following studies were initiated by the Office of Puget Sound (OPS) to provide perspective on newly generated data and/or to increase the utility and quality of the information being gathered.

1. **Puget Sound Ambient Monitoring Program.** The OPS funded the development of this program. OPS is currently funding one position at the Puget Sound Water Quality Authority to ensure that this long term monitoring program is initiated. The priority items identified by OPS and the PSWQA for monitoring are listed in Table 2.2.

Table 2.2

Summary of Proposed Ambient Monitoring Parameters

Sediment Monitoring
- Sediment Chemistry
- Bioassays
- Benthic Community Analysis

Water Column Monitoring
- Temperature
- Salinity
- Dissolved Oxygen
- Turbidity
- Nutrients
- Chlorophyll
- Pathogen Indicators
- Odors, Floatables, Spills

Biological Monitoring
- Fish Abundance
- Toxic Chemicals in Fish
- Fish Disease
- Shellfish Abundance
- Toxics in Shellfish
- Paralytic Shellfish Poisoning
- Bacteria in Shellfish
- Marine Mammals
- Birds

River and Streams Monitoring
- River Mouth Sediments
- River Mouth Water Column Parameters
- River and Streams Programs

Habitat Monitoring

2. **Recommended Protocols for Measuring Selected Environmental Variables in Puget Sound.** In FY86-87 the OPS funded the development of a manual of sampling and analysis protocols. The objective of this effort was to promote consistency and quality in the field and laboratory measurements of environmental variables from Puget Sound. In FY88 chapters addressing the analysis of organic chemicals and metals were revised. In addition, two new chapters have been added, one addressing procedures for fish trawling and the second addressing techniques for making measurements in the fresh waters flowing into Puget Sound.

3. **Development of Sediment Quality Values For Puget Sound.** During 1988, OPS built upon contaminated sediments work initiated in 1986-87 by sponsoring further field validation of the Apparent Effects Threshold approach (AET) for assessing biological effects of sediment contamination. As part of this evaluation, AET values for 56 chemicals were applied in a predictive manner to recently generated sediment chemistry and bioeffects data from Elliott Bay, Eagle Harbor and Everett Harbor. The results of this analysis indicate that AET are reliable predictors of adverse biological effects in the field.

   The Washington State Department of Ecology is currently developing state sediment quality standards for use in regulating sources of sediment contamination and identifying and designating sediments that have adverse effects to biological resources or correspond to significant health risks to humans. It is anticipated that these standards will be based, in part, on the AET approach. The state standards, which are scheduled to become final regulations by June 30, 1989 will be used by Ecology to identify sites with unacceptable sediment contamination, and as a basis for limiting industrial and municipal discharges and nonpoint sources that cause sediment contamination in excess of the standards.

Status of FY88 Office of Puget Sound Commitments

1. **Sampling and analysis workplans.** Workplans for the Puget Sound Ambient Monitoring Program are being prepared by the state agencies which will perform the work. The first plan to be completed was by the Washington Department of Ecology. This plan was distributed to the Monitoring Management Committee in October, 1988. Sampling will begin in the spring of 1989.

2. **Evaluation of Sediment Bioassays.** In 1988 the OPS initiated a bioassay comparison to evaluate the sensitivity, statistical power and cost-effectiveness of the principal bioassay techniques currently available for use in Puget Sound. The results of the efforts will provide guidance to managers in the selection of bioassays for ambient and compliance monitoring, intensive surveys and other studies in Puget Sound. As part of this investigation, eleven acute and sublethal tests were evaluated based on exposure of test species to sediment from Elliott Bay, Commencement Bay and Eagle Habor. Sampling areas were selected to represent different kinds of contamination (complex mixture, metals, and polynuclear aromatic hydrocarbons). The final report on the bioassay comparison will be completed during the spring of 1989.

3. **Monitoring Programs Database System Design.** A data management system has been designed for the Puget Sound Ambient Monitoring Program (PSAMP) to allow a Sound-wide approach to summarizing monitoring information and to support ongoing agency regulatory and resource management activities. The systems will consist of databases maintained by the agencies conducting monitoring, a central database used for data integration and analysis and probably a geographic information system. Comparability of data will be assured by the use of standard data transfer formats by the state agencies collecting monitoring information.

   At present, the state departments of Ecology, Social and Health Services, and Fisheries have begun to design and build monitoring databases. A preliminary design for the central database has been prepared, and the database will be implemented in 1989. Recommendations on a geographic information system design will be adopted by the PSAMP Steering Committee in the summer of 1989.

4. **Evaluation of linking the Puget Sound Environmental Atlas and the Puget Sound Ambient Monitoring Program Database.** The purpose of the project is to make recommendations for regularly updating the Puget Sound Geographic Information System (GIS), estimating costs to create and maintain such a system, and assessing how such a system could share data with other systems in federal, state, and local agencies. The 1989 Puget Sound Water Quality Management Plan requires the PSAMP Steering Committee to adopt a recommendation on GIS by June of 1989. The Office of Puget Sound is funding a work assignment to create and update a Puget Sound Geographic Information System from the existing Puget Sound Environmental Atlas Files.

5. **State of the Sound Report.** Office of Puget Sound staff authored several sections of the 1988 State of the Sound Report. In addition, OPS staff reviewed and critiqued several drafts of the entire report. This report was released by the Puget Sound Water Quality Authority in May, 1988.

Puget Sound Environmental Indicators
FY 89 and Beyond

Information will continue to be collected and evaluated for the following specific indicators of Puget Sound's environmental health.

Sediment Indicators

- Sediment Chemistry (toxics and conventional parameters)
- Sediment Bioassays
- Benthic Community Analysis

Water Column Indicators

- Dissolved Oxygen
- Turbidity
- Nutrients
- Chlorophyll
- Pathogen Indicators

Biological Indicators

- Fish Abundance
- Chemicals in Fish Tissue
- Fish Disease
- Shellfish Abundance
- Bacteria in Shellfish

Habitat Indicators

- Wetland/Habitat Quality and Quantity

Short-Term Toxics Control Indicators

- Effluent and Near-source Ambient Biomontoring

Puget Sound Environmental Indicators FY 89 and Beyond (Continued)

The Office of Puget Sound will continue to measure and track the conditions of Puget Sound through various activities, including:

- funding studies characterizing and identifying emerging problems and issues in Puget Sound,
- funding studies to establish baseline conditions for high priority variables where little information now exists,
- establishing protocols for sampling and analyzing high priority environmental variables,
- working with the Puget Sound Water Quality Authority to ensure that the Puget Sound Ambient Monitoring Program continues to be implemented and results reported, and
- working with the Department of Ecology to ensure that toxic chemical source control efforts are given high priority through Ecology's participation in the Urban Action Programs.

The following environmental indicator-related activities will be initiated or completed in FY89:

1. Pesticide levels in sediments from several locations around Puget Sound will be determined. Levels of approximately 20 pesticides will be measured near the mouths of rivers in areas of sediment deposition.
2. The trends in the occurrences of paralytic shellfish poisoning (PSP) at various Puget Sound beaches over the past decade will be documented. A database will be developed for PSP occurrences to assist in this and future analyses.
3. A study to assess the significance of atmospheric loading of contaminants to Puget Sound will be initiated in FY89. The initial literature review and detailed sampling plan will be completed and sampling will be initiated.
4. The development of a protocol for monitoring and quantifying loss rates of wetland habitat will be completed. Once the results of the pilot project are finalized, the Office of Puget Sound will encourage and facilitate their inclusion into appropriate estuary programs.
5. A trends assessment in wetlands loss over time will be completed.
6. A wetland mitigation monitoring protocol will be completed.
7. A study of trends in marine fish will be completed. The final report will discuss trends in fish populations and will include a listing of stations that should be adopted for inclusion in the Puget Sound Ambient Monitoring Program for continuing trends assessment.
8. Selected Region 10 employees (active and retired) will be contacted about photographic documentation of past Puget Sound water quality problems. Good slides, photographs, or video tapes that can be obtained will be archived for future reference.

Chapter 3: Construction Grants

Environmental Indicator for Municipal Facilities Construction Outreach, and Sludge Programs
FY88

Biochemical Oxygen Demand (BOD) and Suspended Solids Improvements at Completed Construction Grants Projects Initiating Operation During FY 88

The Construction Grants program looked into expanding the above measure to address the following areas:

1) pushing the baseline back in time;
2) adding a measure of the results achieved by operation and maintenance efforts;
3) estimating decreases in residual chlorine;
4) adding a measure of toxics eliminated, and
5) reviewing potential candidates for before and after monitoring.

Introduction

Our report on environmental indicators for the construction grants program covers the 16 municipal wastewater treatment facilities that initiated operation during FY88. As promised in our original proposal, this initial effort also discusses additional indicators that could be included in future reports.

The first section of the report provides data for FY88 on theoretically avoided discharge of biological oxygen demand (BOD) and suspended solids (SS). We have estimated reductions in discharges of three toxic metals (cadmium, arsenic, and chromium). Information is also provided on sludge quantities placed into recycling and candidates for before-and-after stream studies.

The second section discusses future use of additional indicators such as improvements from operations management evaluations (OMEs), historical changes in BOD/SS discharges, and reduction of chlorine discharges.

1. Pollutant Discharges Avoided

The 16 projects that initiated operation during FY88 provided additional capacity to avoid future pollutant loadings and directly reduced current pollutant loadings as follows:

Pollutant	Total Pounds/Day Avoided
BOD	5,400 lbs./day (1.9 million lbs./year)
SS	4,300 lbs./day (1.6 million lbs./year)
Cadmium	0.04 lbs./day (14 lbs./year)
Arsenic	0.02 lbs./day (7 lbs./year)
Chromium	0.67 lbs./day (244 lbs./year)

This is the equivalent of totally eliminating the discharge of 3 million gallons of raw wastewater, or of upgrading a treatment plant of about 8 million gallons from primary treatment to secondary treatment. This is the quantity of sewage generated by a town the size of Port Angeles, Washington or Couer d'Alene, Idaho. About 42% of the BOD, 52% of the SS, and 45% of the metals avoided comes from plants upgrading their level of treatment and so are immediate reductions in current discharges. The remainder is associated with future flows at newly expanded treatment plants.

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2. Sludge Shifted to Recycling

A major feature of the Administrator's 1984 policy on sludge management is to encourage the beneficial use and recycling of sludge, which contains significant levels of fertilizer quality nitrogen. Landfilling or incineration of sludge constitutes the loss of a potentially valuable resource.

Two facilities completed significant sludge treatment and/or sludge handling construction projects during FY88. Pocatello, Idaho improved its sludge dewatering and handling facilities. The city will continue the current practice of recycling sludge using agricultural landspreading. The city of Newburg expanded the wastewater treatment plant and constructed a composting facility. These new facilities will allow the city to shift from agricultural landspreading of sludge to distribution of sludge compost, a more marketable product.

Project	**Old Practice**	**Quantity***	**New Practice**	**Quantity***	**Increased Recycling**
Newburg	Landspreading	0.8 T/Day	Composting	2.8 T/Day	2.0 T/Day
Pocatello	Landspreading	0.8 T/Day	Landspreading	0.8 T/Day	0.0 T/Day
Totals:		**1.6 T/Day**		**3.6 T/Day**	**2.0 T/Day**

* *All quantities in tons/day dry weight*

3. Before/After Receiving Water Studies

Before and after studies are planned for the two marine combined sewer overflow (MCSO) projects which will be funded in the region. Both Coos Bay and Seattle METRO had to explain the significance to water quality and water uses of the overflows in applying for their MCSO grants. Conditions are being placed in the grants requiring them to document the water quality changes which result from construction of the overflow elimination facilities. These reports should be available some time after construction is completed.

Each year, projects that are scheduled for treatment changes or expansions are also candidates for before-and-after studies of stream quality improvements. Each year such a list will be considered by EPA's water planning program along with other proposals for stream studies. The stream studies to be funded for the coming year will appear in the annual State/EPA Agreements (SEAs) prepared each July. In future environmental indicators reports, we will list any construction grants projects selected for stream studies and summarize the results of any studies completed the previous year.

In Region 10 there are few municipal plants that are major water quality problems by themselves. The most serious problems have already been corrected. Before-and-after studies for grant projects will probably have a lower priority than studies to support permits issuance or to resolve pressing water quality problems. We expect about one study every couple years, region-wide, primarily where a construction project is on a stream which also needs a study for other reasons. Before-and-after studies are most likely to be conducted where a currently planned stream study can be modified with minimal effort and cost.

Potential Environmental Indicators

The additional indicators we proposed to review and evaluate for future use are discussed below. These are discharge improvements resulting from operation management evaluations (OMEs), a historical picture of BOD and SS reductions, and reduction of chlorine discharges.

1) Discharge Improvements from OMEs

We reviewed the potential to measure the reduction of pollutants discharges which results from operation management evaluations (OMEs). The last national report on the OME program found that, of 35 plants with known compliance problems, 15 improved performance and 12 achieved full compliance with OMEs. See the report--"A Preliminary Report to Congress on Training for Operators of Municipal Wastewater Treatment Plants," March 1984, page 11. However to document this achievement the agency gave a special grant to the National Demonstration Water Project.

Our field experience indicates that the OME teams often find errors in laboratory testing procedures which would invalidate the permit discharge monitoring report (DMR) data submitted before the OME visit. This is particularly common at small plants. We reviewed the DMRs and OME reports for three facilities in Idaho to determine whether we could use the discharge data from these reports as an environmental indicator since they are easily available. We found that there is no practical way to determine which of the communities who received OMEs have reliable reports on their pollutant discharges before the OME was performed. Without data on what was discharged before the OME, an estimate cannot be made of the effluent improvements resulting from the OME.

During the coming year we will review the OME reports to see what other types of information are available that can be summarized into categories reflecting improved environmental discharges or improved facility operations or management. We have one other source of information about the results of OMEs. A consultant has been doing a national report on the improvements at treatment plants that have received operation management evaluations. We hope to have the report available in early summer 1989. Copies will be placed in the regional library and distributed to the state environmental agencies as soon as we receive it.

2. Historical Data on BOD/SS Reductions

The goal of this indicator would be to estimate BOD reductions realized from the past years of sewage treatment plant construction. For the FY89 report we will look into developing these estimates using prior needs surveys. This would give us a broad brush estimate valid only at the regional or perhaps state level. This cannot be initiated until the prior needs survey data is recalled from tape storage and programmed for accessing and special reports. This was not approved for funding in FY89. In the spring of 1989 we will know if this project is on the approved work list for FY90. If we cannot obtain this access to the old needs surveys, then this indicator project should be dropped.

3. Reduced Discharge of Excessive Chlorine

Reducing discharge of excessive chlorine often involves modifying the chlorine feed system so it can operate on a flow-proportional basis. This is usually done in response to a change in the NPDES discharge permit and occasionally involves an EPA construction grant. The NPDES permits program will review the procedures for developing an indicator on this and address this potential measure in the next environmental indicators report.

Construction Grants Environmental Indicators FY 89 and Beyond

The environmental indicators report for FY89 will include the following elements:

1. **Estimates for the avoided discharge of pollutants from grants projects initiating operation;**
2. **Shifting of sewage treatment sludges to beneficial use;**
3. **Any grant facilities selected for before/after studies of receiving waters; and**
4. **An indicator of successes or benefits from the operation and maintenance program. The type of indicator(s) to use for the operation and maintenance program is still being evaluated.**

We will continue our efforts to gain access to historical needs survey data for developing an estimate of past discharge improvements provided by the program. And we will report on these indicators each September according to the accountability system commitments.

Chapter 4: Drinking Water

Drinking Water Environmental Indicators
FY 88

1. Public Water Systems in Significant Non-compliance (SNC)

- **By state, number of systems in SNC**
- **By state, number and percentage of SNCs for which various "return to compliance" actions have been taken**

2. Drinking Water Enforcement

- **By state, total number of state and EPA enforcement actions**
- **Percentage of SNCs addressed by enforcement actions**

3. Compliance Trends

- **By state, graphically show percentage of PWS in compliance with bacteriological and turbidity monitoring requirements**
- **By state, graphically show percentage of PWS in compliance with bacteriological and turbidity MCLs**

4. Population at Risk

- **By state*, number of persons served by systems in SNC and as percentage of total population served by public water systems**
- **By state*, number of persons served by systems in full compliance and as percentage of total population served by public water systems**

5. Treatment of Surface Water

- **By state*, number and percentage of community systems with surface water sources which use filtration or equivalent**
- **By state*, number and percentage of non-community systems with surface water sources which use filtration or equivalent**

6. Drinking Water Quality Index

- **In FY 88 we will also attempt to develop a "Drinking Water Quality Index" which would provide a concise, general indicator of compliance trends in the program.**

** Indians as a group treated as an additional state*

Introduction

The Safe Drinking Water Act (SDWA) was originally passed in 1974 and reflects Congress' intent to structure a national Drinking Water Program run primarily by the states with EPA oversight. The SDWA applies to public water systems which are defined as those which have 15 or more service connections or serve 25 or more persons at least 60 days per year.

Public water systems have been divided into two categories known as community and non-community water systems. Community systems serve year round residential populations (peoples' homes fit in this category) and non-community systems serve transient populations (restaurants and campgounds are good examples). This distinction was made to facilitate adaptation of monitoring requirements to the type of health risk expected to result from various water use patterns. Some contaminants cause acute symptoms, meaning that a single exposure to the contaminant can cause illness. All systems, both community and non-community are required to monitor for contaminants in this group. Other contaminants cause chronic symptoms, meaning that exposure to the contaminant over a long period of time (many years) can cause symptoms. Only community systems are required to monitor for these contaminants. Thus, non-community systems, from which chronic contaminants would be expected to impose minimal health risks because of the short time of exposure, are not required to expend resources for analyses that would provide little or no health benefit.

State drinking water programs developed in response to the SDWA have addressed primarily contaminants that have traditionally been concerns in drinking water. These include microbiological contaminants, turbidity, and heavy metals such as arsenic, lead, and mercury. In general, the greatest emphasis has been placed on microbiological contaminants and turbidity, because they are considered acute contaminants.

Turbidity is a concern because it may shield microorganisms from disinfectants or interfere with testing for microbiological contaminants. Nitrate has also received some attention and is becoming a more common problem in some areas of Region 10. Other inorganic contaminants have only rarely been encountered at problem levels in Region 10 water supplies. The environmental indicators included in this package focus almost exclusively on microbiological contaminants and turbidity which have been the root of most of the non-compliance in the four Region 10 states.

In 1986, the SDWA was extensively amended to require regulation of a much longer list of contaminants. EPA is in the process of developing regulations to cover 83 contaminants and as a result, we would expect that more and different environmental indicators will be needed in the future.

1. Public Water Systems in Significant Noncompliance (SNC)

Description

This indicator tells us the number of public water systems (PWS) defined as being in significant noncompliance (SNC) with bacteriological and turbidity maximum contaminant level (MCL) and monitoring requirements. Data for this environmental indicator is taken from the SNC list which is generated from the Federal Reporting Data System (FRDS). It is designed to focus the attention of EPA and the states on those systems which have the most severe and persistent violations of Safe Drinking Water Act requirements.

Limitations

This indicator addresses only a portion of the total violations contained in FRDS. The SNC list is a subset of the FRDS violation data base which contains all of the violation data submitted to EPA by the states. The list is distributed to the regions on a quarterly basis. It provides only an historical perspective, because it is comprised of those systems which have, for the past two quarters, met the criteria for being an SNC. SNC status is based on the one year period which began approximately 18 months prior to the most current list.

This indicator is broader than the "Number of Enforcement Actions" indicator and does not specifically show that number. This indicator does not provide any information about PWS which are in violation of MCL and monitoring requirements, but for which violations are not persistent enough to be considered SNC.

Results

This indicator is an after-the-fact review of the number and percentage of SNCs that have returned to compliance or have been the subject of timely and appropriate enforcement action. The goal is to have no SNCs, and this indicator tracks progress toward that goal. SNCs may be returned to compliance by state actions or by EPA action if states fail to respond in a timely and appropriate manner. Actions other than formal enforcement may be successful in returning a SNC to compliance. This report tracks the number and percentage of SNCs for which each category of action has been taken, including "no appropriate action". SNCs in this latter category are evaluated to determine appropriateness of direct EPA action. Tables 4.1 through 4.4 show a tabulation of activities relating to SNCs.

Table 4.1
Gross number of SNCs reported by HQ
(3 quarter lag)

	3rd Qtr		4th Qtr		1st Qtr		2nd Qtr	
	9/30/87		12/31/87		3/31/88		6/30/88	
State	**T"04"**	**A**	**T"01"**	**A**	**T"02"**	**A**	**T"03"**	**A**
AK	88	82	84	75	75	70	70	65
ID	8	3	7	1	7	9	7	7
OR	16	13*	15	15	15	15	15	7
WA	50	42	48	40	40	26	32	27
Totals	**162**	**140**	**154**	**131**	**137**	**120**	**124**	**106**

T=Target
A=Actual

* *Region 10 added 2 additional systems that weren't in FRDS to bring number up to 15.*

Table 4.2
Number of SNCs (from Table 4.1) **receiving formal enforcement actions**

	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr
AK	32	27	17	11
ID	2	0	6	7
OR	12	14	12	7
WA	26	21	19	19
Totals	**72**	**62**	**54**	**44**

Table 4.3
Number of none of previous (unresolved systems from Tables 4.1 and 4.2) **SNCs receiving acceptable state action** (no targets)

	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr
AK	48	47	53	54
ID	1	1	3	0
OR	1*	1	3	0
WA	16	19	7	8
Totals	**66**	**68**	**66**	**62**

Table4.4
SNCs with no acceptable action to date

	1st Qtr	2nd Qtr	3rd Qtr	4th Qtr
AK	2	1	0	0
ID	0	0	0	0
OR	0	0	0	0
WA	0	0	0	0
Totals	**2**	**1**	**0**	**0**

Future Directions

Most of the PWS that appear on the SNC list are very small and consequently usually have very limited resources. Because of the resource limitations and lack of sophistication at most small water systems, and SNCs in particular, we will need to be creative in developing technical assistance, training, and/or enforcement approaches that are effective under these circumstances. Some experimenting appears appropriate.

The states have in general been effective in preventing new names from appearing on the SNC list. We anticipate that those techniques that work will be more extensively used in the future and that information can be exchanged among states.

We may also try to relate this indicator to the two other current indicators that address the population served by systems in SNC and the population served by systems in complete compliance.

2. Drinking Water Enforcement: Number of Actions

Description

This indicator quantifies the enforcement activity by the states and EPA in response to significant noncompliance (SNC) with drinking water regulations.

Limitations

Although this indicator tells us how much formal enforcement activity is occurring, it does not tell us how much activity is occurring at a less formal level. This indicator also assumes that formal enforcement is the best approach for all cases of SNCs, which may not be true for many small water systems that have very limited technical and financial resources. Some of the states have lamented the inability to do a comparative measurement of the effectiveness of technical assistance/plan and specification review versus enforcement; i.e., the preventative approach versus enforcement for small systems. The goal of the drinking water program is to ensure that public water systems provide consumers with drinking water that does not impose a risk to their health. This can probably be best achieved over the long term by having competent people concerned about the quality of drinking water distributed. Our goal is to initiate enough enforcement actions to convince all system operators that they need to be concerned. There is some apprehension that enforcement may promote an orientation toward short term fixes, in that systems will focus on alleviating the immediate problem which precipitated the enforcement, rather than maximizing the quality of their drinking water in the long term. Enforcement is also very expensive in terms of regulatory agency resources.

Results

Table 4.5 shows the total number of enforcement actions occurring in each state during each fiscal year. All actions displayed were initiated by the states unless marked as being EPA actions. The numbers in this table span time periods both before and after the Safe Drinking Water Act Amendments (SDWAA) which were passed June 19, 1986. The SDWAA gave EPA authority to issue Administrative Orders which increased the number of actions EPA could initiate. EPA has initiated several actions in Alaska to at least partially supplant the reduction in state actions that occurred as a result of staff vacancies in the state program during FY 88. Enforcement actions are most likely to be initiated against SNC systems, but may also be initiated against systems that are not yet included on the SNC list. In some cases the number of enforcement actions initiated may significantly exceed the number of systems on the SNC list. This has occurred in Idaho where the number of actions approaches three times the number of SNCs.

Table 4.5
Total Enforcement Actions by State and EPA

	AK		ID		OR		WA	
FY	No.	%SNC*	No.	%SNC*	No.	%SNC*	No.	%SNC*
85	4		3		1.0 EPA		23	
86	38		17		7		45	
87	17 8.0 EPA	26	29	322**	13	32	17	28
88	8.0 EPA		23	255**	95		14.0ST 12.0 EPA	62

* *Percentage of total SNCs addressed by enforcement actions; SNC list not produced prior to FY87; percentage based on SNCs as of end of previous calendar year, i.e., FY87 based on SNCs as of 12/31/86*

** *Enforcement actions may be initiated for violations not yet classified as SNC.*

Future Directions

A potential change to this environmental indicator would be an attempt to evaluate the relative effectiveness of enforcement versus technical assistance or other activities in various situations. This could be especially useful in deciding which technique would be most effective for a particular case and also in applying limited resources in the most efficient manner. Projects which may provide some insight into this comparison have been proposed but not yet funded.

3. Compliance Trends for Monitoring and Maximum Contaminant Level (MCL)

Description

This indicator tells us the percentage of Public Water Systems (PWS) that report monitoring results for bacteriological contaminants and turbidity and the percentage of PWS that are in compliance with MCLs. These charts graphically show the trend in monitoring and MCL compliance by quarter for each state and were generated from numbers extracted from the Federal Reporting Data System (FRDS) which contains all PWS violation data submitted by states.

Limitations

These trend lines represent compliance information for only two of approximately thirty contaminants that are now regulated, but they are considered two of the most important. Trend lines for most of the other contaminants would be less meaningful, because concentrations of these contaminants do not experience the variation associated with bacteriological contaminants and turbidity. As a result, compliance periods are long (monitoring is required only at infrequent intervals of one to four years) and periods of ten or more years would be required to establish monitoring trends. In addition, very few public water systems in Region 10 have experienced MCL violations for contaminants other than bacteriological contaminants and turbidity. This means that the trend is essentially constant at 100% compliance.

Results

It can be seen (Figures 4.1 through 4.15) that compliance by very small PWS, those serving 100 or fewer persons, tends to be lower than for PWS serving more than 100 persons. Other population breakdowns could be selected, but in general, small PWS are less sophisticated and have fewer resources than larger PWS. This usually results in lesser ability to understand and routinely comply with requirements.

For Alaska, the compliance rates for bacteriological MCLs may be artificially high because corresponding monitoring compliance rates are relatively low, i.e., MCLs will not be detected without monitoring. However, it should not be assumed that MCLs will increase disproportionately with improvements in monitoring compliance. There is also a discrepancy between the way Alaska defines bacteriological MCLs and the way EPA defines bacteriological MCLs. The Alaska method results in fewer MCLs and is an issue that will be resolved when Alaska develops new state regulations in response to EPA's new Coliform Rule which will be promulgated in June of 1989. Also, the Alaska data system does not currently have the ability to provide bacteriological MCL reports for inclusion in FRDS. This inability to report MCL data is a serious concern and precludes preparation of a trend line. However, the state does devote considerable energy to follow-up of all positive bacteriological test results, so it is believed that a serious risk to public health does not exist. Data management system revisions currently underway will remedy this problem.

Future Directions

Other population breakdowns could be selected to address some specific issue or additional contaminants could be added in the future. No changes are envisioned at this time.

4. Population at Risk: Population Served by Systems in Significant Noncompliance (SNC) and in Full Compliance

Description

This indicator tells us the population and percentage of population within the total population served by public water systems (PWS), consuming drinking water from systems known to be in SNC and those that are in full compliance. SNC is currently defined as having exceeded the maximum contaminant level (MCL) for coliform or turbidity for four or more months in any twelve consecutive months or having done no monitoring for coliform or turbidity for twelve consecutive months. Full compliance is defined as having no violations of either MCLs or monitoring requirements.

Limitations

This indicator requires some interpretation to tell us the number of individuals exposed to contaminated drinking water. There are two major reasons for this. First, only systems which have exceeded the MCL for four or more months are included in the SNC category. Many more systems may exceed the MCL for three of fewer months, thus exposing consumers to contaminated drinking water for shorter periods of time. Second, those systems which are in SNC for monitoring are not necessarily serving contaminated drinking water. Without monitoring, no one knows what they are serving. It is also important to understand that the correlation between consuming water from a system in SNC and the risk to health is not clearly defined. It is safe to presume that health risk is higher when contamination is known to be present or when monitoring has not been conducted to demonstrate that contamination was not detected. The goal for this indicator is to show that no one consumes drinking water from a PWS in SNC. Ideally, it would also show that the total population served by PWS consumes drinking water from systems in full compliance. However, many PWS are neither in SNC (a rather gross degree of noncompliance) or full compliance. All PWS that are not in SNC or full compliance have had some degree of noncompliance with associated potential health risk.

Results

Table 4.6 shows the population in each state served by systems in SNC during state fiscal years 87 and 88. The table also shows the population served by systems in SNC as a percentage of the total population served by public water systems in each state (percent of total population served). The remaining column represents the change in population (FY change in population), either increase or decrease during the most recent fiscal year, served by systems in SNC.

Table 4.6

Population Served by Systems in SNC

State	FY 87* Pop. Served by Systems in SNC	% of Total Pop. Served	FY 88** Pop. Served by Systems in SNC	Change in Pop. FY87 to FY88
AK	16,450	5%	17,395	+945
ID	650	<1%	1,125	+475
OR	42,150	2%	27,230	-14,920
WA	57,400	2%	42,230	-15,170
Total	**116,650**	**2%**	**87,980**	**-28,670**

** Numbers have been rounded and apply to the compliance period ending 6/87.*

*** Numbers have been rounded and apply to the compliance period ending 6/88.*

Table 4.7 shows the population in each state served by community systems in complete compliance. It also indicates the percentage of the total population served by community water systems that this population represents. Data for two fiscal years are presented. Populations represented in this chart are served by systems which had no violations during the fiscal year.

Table 4.7

Population Served by Systems in Complete Compliance

State	FY 87 Pop. in Complete Compliance	% of Total Pop. Served	FY 88 Pop. in Complete Compliance	% of Total Pop. Served
AK	104,275	29	79,351	22
ID	510,012	71	419,361	58
OR	1,798,356	87	1,813,759	85
WA	1,774,519	47	2,091,473	54
Total	**4,187,162**	**60**	**4,403,934**	**62**

Alaska and Idaho have both had staffing problems during the period addressed in these tables. It is assumed that the increase in population served by systems in SNC and the decrease in the percentage of the population served by systems in complete compliance can be related to these problems in both states. By contrast, both Oregon and Washington were able to significantly reduce the population served by systems in SNC. However, the population served by systems in complete compliance in these two states did not change significantly, which may be a reflection of the major new workload imposed on states by the Safe Drinking Water Act Amendments of 1986.

Future Directions

SNC may be redefined in the future to be more restrictive. It might also be possible to track the population served by water systems that were not in complete compliance as well as those that were in SNC. Other possibilities would be to differentiate between SNC for MCL and SNC for monitoring because, presumably, there is higher risk from consuming water known to be contaminated than in consuming water that has not been monitored and may or may not be contaminated.

5. Treatment of Surface Water: Number and Percent of Surface Water Systems Using Filtration or Equivalent

Description

Some public water systems use surface water (all waters such as streams and lakes which are open to the atmosphere) as a source of supply. Such waters, because they directly receive runoff from the adjacent land surfaces, are quite vulnerable to contamination by particulate matter, cysts, bacteria, and viruses. Cysts, bacteria, and viruses are microbiological contaminants which may cause illness. Filtration is known to be an effective method of removing particulate matter, including cysts, bacteria, and viruses from drinking water, thus reducing the potential for disease-causing organisms to reach the consumer. Ideally, all public water systems using surface water sources would provide filtration. This indicator is a measure of how near we are to achieving this goal.

Limitations

In some cases other treatment techniques can provide health protection believed to be equivalent to that provided by filtration. These cases, which will probably include Seattle, Tacoma, and Portland (all with large populations served) would not be reflected by the subject indicator. This indicator would also assume that filtration systems, once installed, would be properly and continuously operated. Because this assumption may not be justified, this indicator could imply that drinking water produced by all systems with filtration is always safe. Statistics on incidences of waterborne disease outbreaks confirm that improperly operated filtration systems are sometimes at fault.

If a measure of the effectiveness of filter operation were added, a more realistic picture would be provided. Operator training and certification could be considered a surrogate measure for the effectiveness of filter operation. Because state review and approval of plans and specifications for installation of filtration systems would be required, this indicator can be assumed to measure the capability of surface water systems to produce safe drinking water, given competent operation.

Results

Table 4.8 shows the number and percent of community systems (those serving a year around residential population) and non-community systems (those serving transient populations) using surface water that provide filtration treatment as of the dates indicated. The complete universe of surface water systems is not shown, but can be calculated with the percentages provided. (All systems are required to monitor for contaminants that cause acute symptoms, while only community systems are required to monitor for contaminants that cause chronic symptoms.)

Table 4.8
Number and Percent of PWS Using Surface Water That Provide Filtration Treatment as of the Dates Shown

	Community				Non-Community			
State	#10/87	%	#9/88	%	#10/87	%	#9/88	%
AK	66	53	71	58	39	25	46	33
ID	39	51	41	54	34	29	35	29
OR	58	34	72	41	8	5	8	5
WA	57	49	63	52	46	46	49	49
INDIAN	2	40	2	40	0	0	0	0

Future Directions

This indicator currently shows only those systems using filtration because the determinations of "equivalent treatment" have not yet been made on a system by system basis. As "equivalent treatment" determinations are made, beginning in FY90, these numbers can be included with the systems having filtration. There may also be some attempt to measure the quality of operation for those systems with filtration.

The Safe Drinking Water Act Amendments (SDWAA) of 1986 will surely impact this environmental indicator. All systems using surface water will be required to install filtration or to satisfy a rather stringent list of criteria to demonstrate that equivalent health protection is being provided. Although many additional contaminants will be regulated under the SDWAA, the list of contaminants for which filtration is considered appropriate treatment will not change. The new contaminants coming under regulation will be largely unaffected by filtration and other treatment techniques will need to be employed.

6. Drinking Water Quality Trend Index

Description

This indicator can be used as a management tool to show improvement or deterioration in drinking water quality as judged by public water system compliance with drinking water regulations. It is simply a dimensionless index number that would show a compliance trend for the selected universe of systems. The number itself would have no meaning. The goal is to have an index of zero.

The index would be derived as a product of the number of systems in violation within the selected universe (state, county, region, populaton size group, etc.), the number of contaminants for which violations occurred, and the duration of the violation. The number obtained for these criteria would create an index for monitoring violations. For MCL violations a fourth term, magnitude of violation, would be added. These numbers can all be readily obtained from the FRDS data base which is routinely maintained for other purposes. To obtain the desired index one needs to select the universe of interest--for example, a state--and ask the computer to calculate the index for that point in time. Indices could be calculated on a periodic basis, probably monthly or quarterly. There is fairly wide latitude in defining the universe of systems addressed and if the calculated index were plotted over a period of time, it would indicate whether compliance was improving or deteriorating within the selected universe.

Limitations

The index would not tell us the actual quality of drinking water. It would also be inappropriate to compare one universe (state, county, etc.) against another on the basis of the index itself because the size of the index would usually be directly proportional to the size of the universe, i.e., the number of systems within the universe. Comparisons between universes could be made on the basis of the rate of change and the direction of change. If the index is getting larger, a deterioration in compliance/quality would be indicated. The index would get smaller as compliance/quality improved, and full compliance would result in an index of zero.

Results

Because we are still developing the computer procedures for producing this index, we have no experience in using it. Consequently, it is difficult to predict how managers may be able to ultimately use the index, but it is anticipated that the manager of any particular universe could use the index to determine compliance trends. A state manager could, for example, quickly see the compliance trend for the state or compare trends for sub-units within the state. EPA could compare trends for states within the region or compare rates of improvement between states. The component numbers needed to produce the index would also be displayed so that a manager could tell whether the index had decreased because fewer systems had violations or were in violation for fewer contaminants, shorter duration, etc.

Future Directions

We have proceeded far enough with development of the computer programs needed to effectively automate calculation of the index to be convinced that it can be done. We will need to experiment with the procedures to learn the easiest, most straight forward ways to use the index, and to learn about sensitivities and constraints.

Figure 4.1

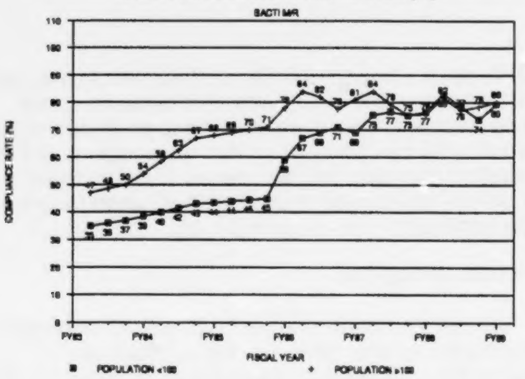

ALASKA COM. PWS COMPLIANCE (%)

Figure 4.2

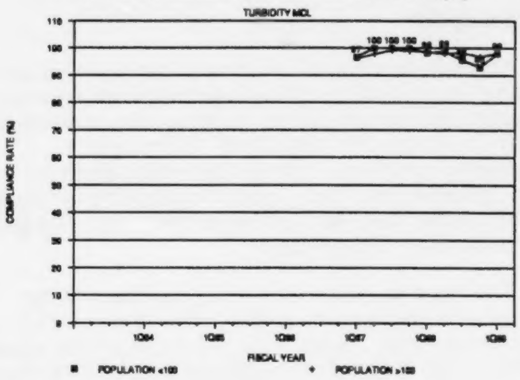

ALASKA COMMUNITY PWS COMPLIANCE (%)

Figure 4.3

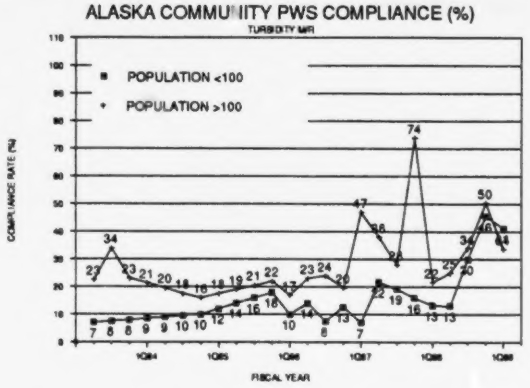

ALASKA COMMUNITY PWS COMPLIANCE (%)

Figure 4.4

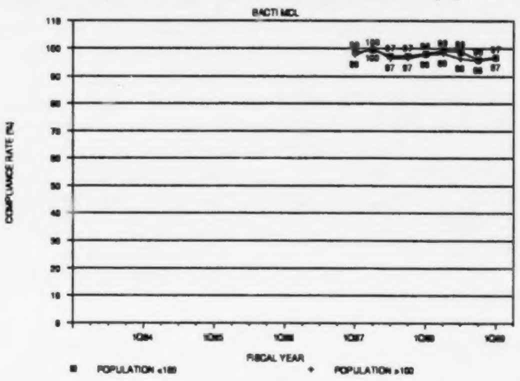

IDAHO COMMUNITY PWS COMPLIANCE (%)

Figure 4.5

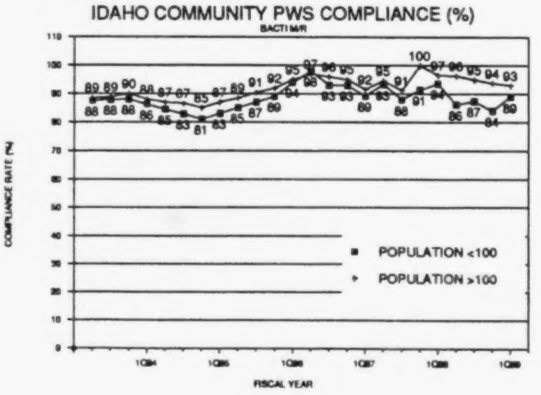

IDAHO COMMUNITY PWS COMPLIANCE (%)

Figure 4.6

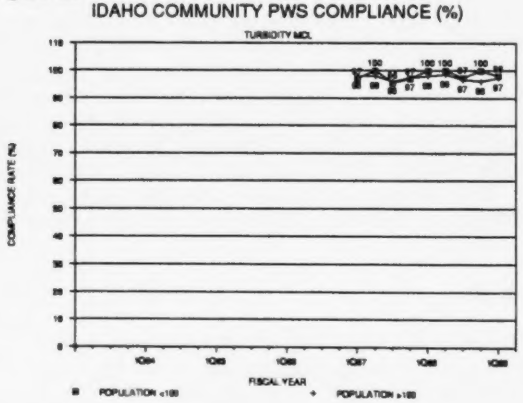

IDAHO COMMUNITY PWS COMPLIANCE (%)

Figure 4.7

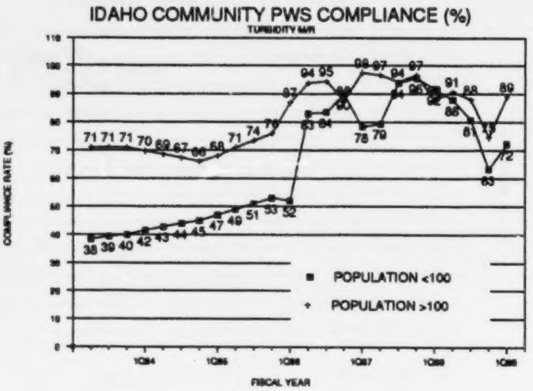


Figure 4.8

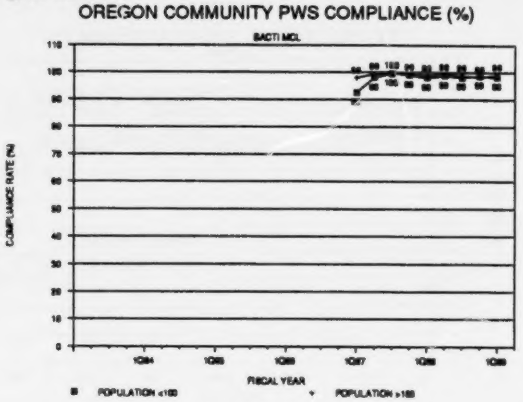


Figure 4.9

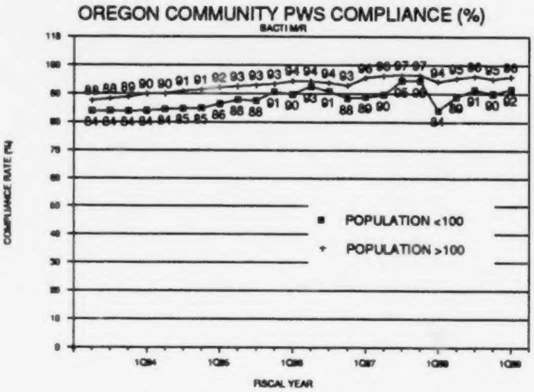


Figure 4.10

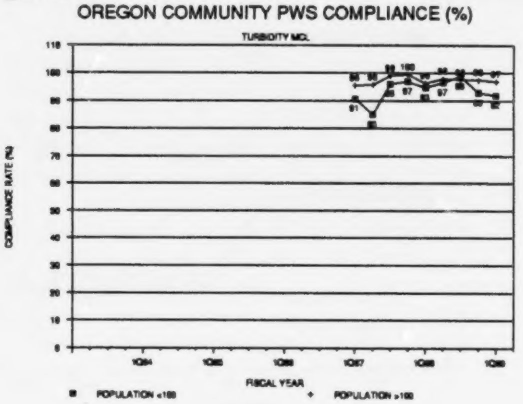


Figure 4.11

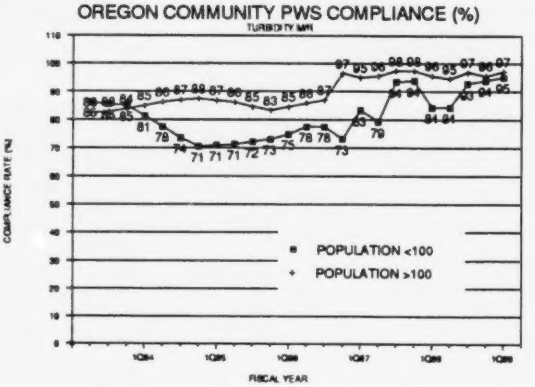


Figure 4.12

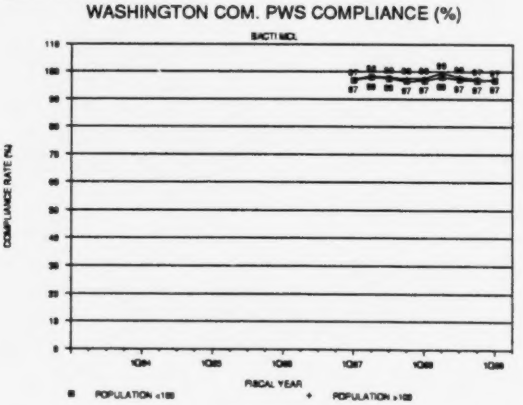


Figure 4.13

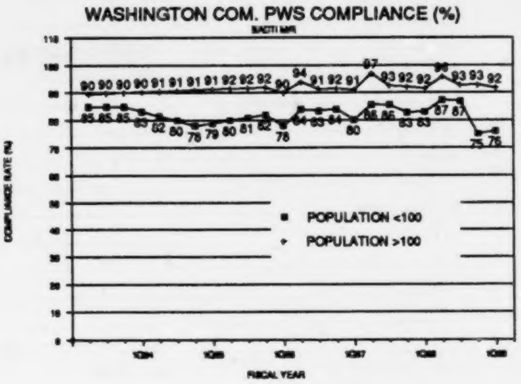


Figure 4.14

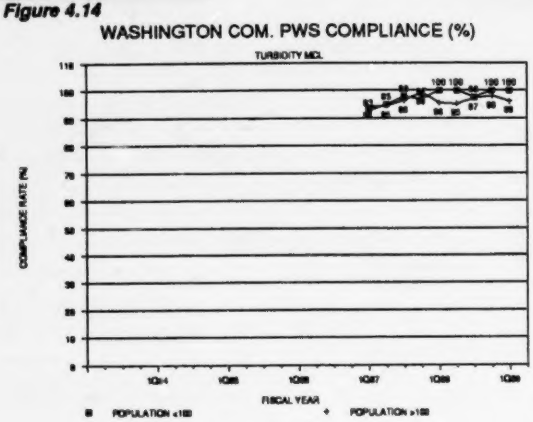
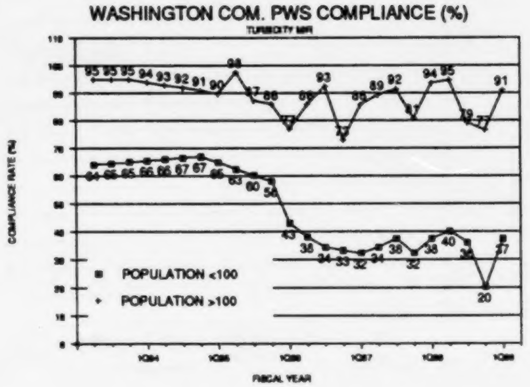


Figure 4.15



Drinking Water Environmental Indicators FY 89 and Beyond

1. **Public Water Systems in Significant Non-compliance (SNC)**
   - By state, number of systems in SNC
   - By state, number and percentage of SNCs for which various "return to compliance" actions have been taken
2. **Drinking Water Enforcement**
   - By state, total number of state and EPA enforcement actions
   - Percentage of SNCs addressed by enforcement actions
3. **Compliance Trends**
   - By state, graphically show percentage of PWS in compliance with bacteriological and turbidity monitoring requirements
   - By state, graphically show percentage of PWS in compliance with bacteriological and turbidity MCLs
4. **Population at Risk**
   - By state*, number of persons served by systems in SNC and as percentage of total population served by public water systems
   - By state*, number of persons served by systems in full compliance and as percentage of total population served by public water systems
5. **Treatment of Surface Water**
   - By state*, number and percentage of community systems with surface water sources which use filtration or equivalent
   - By state*, number and percentage of non-community systems with surface water sources which use filtration or equivalent
6. **Drinking Water Quality Trend Index**
   - Designed as a management tool to show improvement or deterioration in drinking water quality for the selected universe
   - When completed, will show trend of drinking water quality and allow comparison of the rate of change in drinking water quality between universes

Note: Our data systems currently have the ability to generate the needed data, and we are in the process of developing the algorithms necessary for calculation of the Index. When calculation of the Index has been sufficiently automated and appropriate testing has been conducted, the Index will provide managers with a concise, general indicator of compliance trends in the program.

** Indians as a group treated as an additional state*

Chapter 5: Wetlands

Wetlands Environmental Indicators FY 88

1. **Acres of wetland lost**
2. **Acres of wetland impacted**
3. **Acres of wetland mitigated for**
4. **Acres of wetland saved due to project modification, withdrawal or permit denial**
5. **Acres of wetlands lost, impacted, and mitigated by wetland type**
6. **Acres of wetland impacted and mitigated for by project type**
7. **Linear feet of shoreline impacted by state**
8. **Cubic yardage of dredged material allowed in-water and upland in Columbia River and Puget Sound**
9. **Time expenditure of EPA personnel on major and minor wetland projects**
10. **Percentage of projects upon which EPA had substantive comments**
11. **Number of significant environmental issues raised by EPA personnel and number of resolutions**
12. **Number of enforcement actions and number of resolutions**
13. **Number of permits denied as a result of EPA comments**

Purpose

This is the second annual report in which we attempt to assess regional wetland trends and to measure the effectiveness of the Region 10 Environmental Protection Agency's efforts to protect natural aquatic resources in the Pacific Northwest and Alaska. To assess the environmental results of our wetland protection efforts, we calculated the acreages and types of aquatic sites (subject to regulation under Section 404 of the Clean Water Act) that were lost and saved in the Region. This allows us to demonstrate if we are achieving (or helping to achieve) positive environmental results and if not, where and how we may improve or redirect our efforts to address disturbing trends in wetland losses.

Acknowledgments

I wish to acknowledge the efforts of the following people in the preparation of this document. Kathy Kunz has been the person primarily responsible for database development and data evaluation. Without her diligent efforts in overseeing data entry and quality control, we would not have been able to produce this report. Bill Riley and Ron Lee have provided good management support for the concept of a trends assessment and they have directed resources toward data entry. Ron Lee is to be given special recognition for his foresight in developing the initial database (in the early 1980s), which addresses aquatic site acreage losses. Jack Kennedy (U.S. Army Corps of Engineers, Seattle District) was very helpful in providing data on permit actions taken by the Corps over the last 12 years. Tamra Faris, National Marine Fisheries Service (NMFS), has provided EPA with two excellent reports summarizing 404 permit activity in the state of Alaska. All of our Alaska analyses are based on NMFS data. Gaynel Kline provided typing and editing support for this document.

Trends Assessment

Data Limitations

We had initially intended to provide a wetlands trends assessment summarizing wetland trends in each state in Region 10. However, data management difficulties have prevented that from occurring. We will therefore concentrate our efforts on the states of Washington and Alaska. The Oregon and Idaho data (and the EPA Alaska data) will be evaluated in the next annual report.

This assessment is an attempt to delineate and evaluate trends in wetland losses over time by wetland type[1] and to relate these trends to EPA activities. The assessment is based on over 2,700 records of EPA evaluations of U.S. Corps of Engineers public notices for activities requiring a permit under Section 404 of the Clean Water Act or Section 10 of the Rivers and Harbor Act. These public notices were reviewed between 1980 and 1988 (approximately through April, 1988) for the state of Washington and 1981 through 1987 for the state of Alaska. Before presenting these data, it is essential to identify their limitations and the general shortcomings of this analysis.

Despite our efforts, the database is still incomplete with regard to the actual number of permits issued by the Corps. This should not substantially affect the

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[1] *There are five wetland types:*

Marine -	*open ocean and the high energy coastline*
Estuarine -	*deepwater tidal habitats and adjacent tidal wetlands, including emergent saltwater marshes*
Riverine -	*all wetland and deepwater habitats within a channel*
Lacustrine -	*wetlands and deepwater habitats contained within a depression (i.e., lakes)*
Palustrine -	*non-tidal wetlands dominated by trees, shrubs, and persistent emergent vegetation (e.g., wet meadows, freshwater marshes)*

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trends assessment but will have an effect on absolute acreage figures. The Alaska data does not contain the same level of information provided with the Washington data. The reason for this is that the Alaska data were collected and analyzed by NMFS. We are now in the process of entering Alaska data into our database and this should be completed by January, 1989. The NMFS data are very accurate and we have every confidence that the trends analysis based on them is a true reflection of the wetland impacts in Alaska.

These data cover only those projects which require a Corps permit. There are many activities lying outside the Corps jurisdiction which have substantial adverse impacts on wetlands (e.g., draining wetlands). The Washington State Department of Ecology estimates that there are over 500 acres of wetland adversely affected annually which are not regulated by Section 404. In addition, impacts on isolated wetlands and wetlands adjacent to streams above the headwaters (streams with average annual flows of less than 5 cfs) are excluded from this analysis if they occurred prior to 1986, as they were not generally regulated by the Corps. Wetland losses of less than one acre for such wetlands are still not regulated by the Corps, and are thus excluded from the data base. It is also important to note that this database does not include information on those projects which have been proposed but which never reached the stage of public notice, due to withdrawl or Corps rejection of an application due to lack of information.

This database also does not include wetland losses due to emergency activities associated with the eruption of Mount St. Helens in 1980. We have also excluded data from two major projects which will have substantial effects on wetlands: the Green River Sediment Retention Structure and the Cowlitz Falls Hydroelectric Project. Together, these two projects will eliminate several hundred acres of riverine and palustrine wetlands and replace them with even greater acreages of lacustrine habitat. Data from these projects will be included in the next trends assessment when we have been able to more accurately predict wetland acreages lost and gained.

It is important to understand that simply looking at acreage loss or gain is not the best way to evaluate wetland impacts. Ideally, we would like to evaluate wetland functions and values for each individual wetland lost and gained. This is not possible at present but should become more likely in the future as more attention is directed toward identifying and understanding the significance of wetland functions and values.

The data and findings presented here must be considered preliminary. We strongly recommend that the data be used with care and not quoted as final.

Analysis of Trends

Washington. The wetland loss trends in the state of Washington have been analyzed for the Puget Sound area and for the rest of the state separately. Results are presented in Tables 5.1-5.7 and Figures 5.1-5.14. Wetland losses by county are presented in Table 5.11.

The referenced tables and graphs present proposed wetland losses, permitted losses, mitigation acreages, and net loss. The state of Washington has experienced a net loss of just under 550 acres of wetlands from 404 permitted activities in the last 8+ years. Palustrine and riverine habitat losses have been about equal with approximately 246 acres of the former and 242 acres of the latter being adversely affected. Most of the losses (62% for palustrine, 93% of the riverine, and 72% of the estuarine) have occurred outside the Puget Sound area. Over 76% of the total wetland losses in Washington have occurred outside of the Puget Sound area. In the Puget Sound area, King and Snohomish counties have suffered the greatest palustrine and estuarine losses. Grays Harbor County and Pacific County contributed substantially to both the palustrine and estuarine losses, while Cowlitz County along with several eastern Washington counties accounted for most of the riverine losses (see Table 5.11). Although Puget Sound counties accounted for a majority of permits, the actual wetland acreages affected were less than for the rest of the state, although the acreage differences are not meaningful since 1985.

The data show that there is a general trend toward decreasing wetland losses in the state since 1985 (see Figures 5.1-5.13 and Tables 5.1-5.7) in all types of wetlands in both the Puget Sound area and in other areas of the state. In the last 3 years, the data indicate an overall net gain in wetland habitat due primarily to an increase in lacustrine acreage (over 20 acres), although mitigation for palustrine habitat has also resulted in a net gain for this wetland type (see Figure 5.4). No wetland type has lost more than 10 acres since 1985. This is in contrast to the years prior to 1986 when the bulk of wetland losses occurred (91%). The state will gain several hundred more acres of lacustrine habitat in the near future as a result of the construction of the Green River Sediment Retention Structure and the Cowlitz Falls Hydroelectric Project. As noted above, these projects will also result in a net loss of several hundred acres of riverine and palustrine wetlands.

The final net wetland acreage loss (approximately 550 acres) is less than one-third of the proposed loss (1,740 acres) and just over half of the permitted loss (977 acres). Mitigation (429 acres) reduced the permitted acreage to the final net figure (see Figures 5.1, 5.8, and 5.11 and Table 5.2). This indicates that much of the proposed adverse wetland impacts are reduced prior to permit issuance (either through negotiation, permit denial, withdrawal, or reduction in impacts due to project redesign). Approximately 44 percent of the remaining wetland impacts are offset by mitigation (i.e., wetland creation or enhancement).

An initial evaluation of the mitigation data would seem to suggest that mitigation acreage has increased since 1984. However, 200 acres of the pre-1984 mitigation was not performed (the project was never built) and will be eliminated in future evaluations. No discernable mitigation pattern is evident from the data. It is true, however, that all federal and state resource agencies are requiring compensatory mitigation for unavoidable adverse impacts, and that this mitigation is required to be in-kind. The primary effect of stronger agency positions on net wetland impacts is not necessarily an increase in mitigation but rather a decrease from initial proposed losses, due to more searching alternatives analyses. Mitigation is more commonly provided for palustrine and estuarine habitat losses. Lacustrine "mitigation" is usually the result of construction of a reservoir and is generally not in-kind mitigation (this is less desirable than in-kind and is not preferred by any of the state or federal resource agencies).

EPA has objected to approximately 80 projects (under 3%) since 1977, and has requested conditions be placed on 111 proposals (approximately 4%). The wetland acreage avoided in these projects where EPA has voiced objection or required conditions is approximately 272 acres (see Figure 5.14). This is an indication of agency effectiveness in protecting wetland habitats.

The Corps has issued 28 permits over EPA objections since 1977, with no discernable trend. It appears that about 1 percent of all projects will fall into this category. EPA has elevated only one project for higher level (Corps North Pacific Division) review since 1986. This indicates that we are obtaining a satisfactory reduction of outstanding environmental issues of concern prior to invoking the elevation process. It also indicates that in those cases where elevation is technically appropriate, EPA feels the adverse resource impacts do not warrant invoking the 404(q) Memorandum of Agreement elevation procedure. This is true for Oregon, Idaho, and Alaska projects as well.

The analysis of linear feet of shoreline affected (see Figure 5.15) indicates an increasing level of activity. This may be in part because the record keeping prior to 1984 is suspect. The data will eventually indicate a much greater amount of shoreline affected as the two large dam projects referenced above come on line. The issuance of after-the-fact permits by the Seattle District Corps does not evidence any discernable trend but is generally less than one percent of permits issued.

Alaska. The NMFS data on Alaska 404 projects are presented in Tables 5.8-5.10 and Figures 5.16-5.25. The wetland losses in Alaska are substantially greater than in Washington, Oregon, and Idaho combined. It is also evident from the Alaska data that the primary reduction in wetland losses occurs prior to permit issuance (see Graph 16 and Table 9; NMFS personnel claim there is little or no compensatory mitigation in Alaska). The NMFS data are the result of evaluating over 3,000 permits between 1981 and 1987 (of which 84% were issued). It is significant that 48.5% of the wetland acreage proposed for elimination is not affected, as a result of permit withdrawal, denial or modification. Nevertheless, over 5,000 acres of wetland are lost each year in the state of Alaska due to 404 permitted activities. The major impacts are due to three categories of activities: mining, town/homesite construction, and oil and gas development (see Figure 5.25). Mining affects wetlands largely through dredging activities, whereas oil and gas development and town/homesite construction affect wetlands primarily through filling. Due to the acreage of wetlands in Alaska (estimated at approximately 157,000,000 acres by the U.S. Fish and Wildlife Service) the 5,000 acres of lost wetlands per year has less of a percentage impact than the loss of over 60 acres per year in Washington. However, the areas where wetland losses are occurring in Alaska are especially important, either because of substantial historical losses or because they are associated with maintaining important wildlife populations.

There are no obvious trends in these data, although there was a substantial reduction in wetland loss from 1986 to 1987, due primarily to a reduction in impoundments and the resultant decrease in riverine habitat affected. The acreage affected by town and homesite development more than doubled between 1986 and 1987. The NMFS did not break down the 1981 to 1985 data by year, nor did it ascribe specific wetland type losses to specific activities. NMFS has agreed to provide such a breakdown in FY 89.

It is not possible from the NMFS data to determine what effect EPA is having on project outcomes. However, NMFS data indicate the Corps included NMFS recommendations 75 percent of the time.

NMFS did express concern over the number of after-the-fact permits being issued by the Alaska Corps District in 1983, 1984, and 1985 (up to 36 percent of total permits issued). This percentage dropped to less than 10 percent in 1986 and 1987 and, while it is still high, it seems to be in the range of those issued by other districts.

SPMS. Relevant SPMS data for permit reviews in all Region 10 states are presented in Table 5.12.

Table 5.12
SPMS Data for Region 10 States

	FY 86	FY 87	FY 88*
Total Public Notices Reviewed (all states)	1,256	1,003	705
No. Public Notices Raising Significant Issues	223	190	133
No. Resolutions	129	204	150
No. Permit Denials	26	21	12
No. Permits Issued over EPA objections	4	6	6

* *Through 3 quarters*

These data confirm the low rate of disagreement with the Corps over most projects to be permitted under Section 404. Most disagreements revolve around adequacy of the alternatives analysis or mitigation. The trend is toward less disagreement as the agencies agree on policy issues at the national level.

Enforcement. The enforcement trends are indicated in Table 5.13.

Table 5.13
Region 10 Enforcement Activity

Activities	FY83	FY84	FY85	FY86	FY87	FY88
Site Inspections				46	107	112
Administrative Orders	1	2	9	22	8	8
Referrals to DOJ		1			4	0
Consent Decrees				1	1	0
Trials					1	0
Resolutions	1	1	1	12	12	13

The EPA enforcement program continues to stress voluntary compliance as the best way to resolve violations. In addition to the resolutions referenced above, we already anticipate resolution of at least 6 more cases (at least one by consent decree) in the next fiscal year. In addition, we anticipate a trial in either Alaska or Idaho in the coming year. We are also actively seeking candidates for administrative penalties and hope to have our first three for Headquarters review in FY 89.

It is significant to note that we have been successful in obtaining restoration in several cases where the Corps or the State has been unable to do so. In addition, we have found that it is best to initiate a coordinated enforcement effort in conjunction with the Corps, the State, and local government. This has the advantage of establishing a good working relationship among all levels of government as well as educating each level on the needs and requirements of the others. It also allows future enforcement actions to operate more efficiently.

Our quarterly enforcement meetings with the Portland and Seattle District Corps and the states of Washington and Oregon have lead to a cooperative spirit and an efficient distribution and timely resolution of enforcement cases.

Program Status and Direction

The following sections are provided to relate other aspects of the wetlands protection program to present and future measures of environmental protection. While indicators of success may be less quantitative in these areas, they are no less important to the success of the program.

Advanced Identification and Special Area Management Plans

A new program emphasis at EPA has been to actively encourage local governments to properly plan for development where wetlands are under heavy development pressure. In FY88, the regional wetlands program conducted a study of local wetland management efforts in high growth, high wetland resource value areas (see ***Priority Wetlands Threat Assessment***, EPA, 1988). This targeting effort helped identify specific areas where limited funding and technical assistance should be directed to achieve the greatest environmental benefits.

Region 10 is currently involved in several local wetland planning studies. The latest effort in this area concerns the development of a Special Area Management Plan for the Mill Creek Drainage Basin in southern King County. EPA will participate in funding this plan along with the Corps of Engineers and local governments. The goal of this effort is to produce a wetlands management plan that is consistent with local, state, and federal requirements within three years. Agreements reached during the planning process will reduce future conflicts resulting from applications to fill wetland areas. The study will involve an inventory of existing wetlands, an assessment of wetland functions and values, the development of an ecosystem management strategy, and wetland management guidelines. Finally, a wetland management plan will be developed which is accepted and implemented by local governments. The process will involve extensive public participation.

This type of planning effort is appropriate in areas experiencing rapid growth or high development pressure. Such efforts are well underway in Juneau, Alaska and in the Colville River Delta on Alaska's north slope. These will be completed in FY 89. Region 10 expects to help fund a wetland management planning effort in Eugene, Oregon beginning in FY 89 and will provide technical assistance on similar projects in the Columbia South Shore area of Portland and near the mouth of the Columbia River.

Education

EPA is cooperating with the Washington Department of Ecology in the production of a wetlands video targeted to local decision makers. The video will be produced next fiscal year (FY89) and will be used in connection with other materials to assist us in educating local elected officials and planners concerning the wetlands protection requirements of the federal and state government. The lack of awareness on the part of local officials has led to enforcement problems and conflicts over wetland use. EPA will participate with the Washington State Department of Ecology, the Corps, and the Washington State Departments of Fisheries and Wildlife in making presentations to local officials.

EPA has also assisted the Department of Ecology in the production and printing of a new wetlands protection brochure which describes all local, state, and federal programs involving wetland protection. The brochure will be widely distributed in Washington. We believe that increasing public awareness of the value of wetlands and the regulatory program will reduce enforcement cases and reduce conflicts over permitting requirements.

Enforcement

The EPA regional enforcement program is now well established and should be a very effective wetlands protection tool this year. We are especially encouraged by the new opportunity to become more involved in enforcement activities in the state of Idaho. Our involvement there has been minimal in the last half of FY88 due to the absence of wetland protection staff located in the Idaho Operations Office. With a new experienced employee in the office, EPA will be assisting the Corps in obtaining wetland restorations and in seeking appropriate penalties for Clean Water Act violations.

In addition, we will be working closely with the states of Washington and Oregon in an attempt to target areas where violations are particularly numerous in order to initiate appropriate education efforts. This will involve contacting local governments and appropriate target groups (e.g., contractors) and offering an educational program.

The Corps and EPA have reached tentative agreement on a national enforcement MOA. When this agreement is signed (expected shortly), it will signal a new era in EPA enforcement involvement and in EPA/Corps cooperative efforts. It may be necessary for Region 10 EPA to reach agreement with the North Pacific Division concerning enforcement procedures. Under the new MOA, EPA will be given first right of refusal on unpermitted discharge cases (the bulk of the enforcement load). We will therefore have to choose early in the process which enforcement cases we want to take on. This is, in effect, how we operate in Region 10 at the present time. However, a more formal process (with time requirements) will place additional burdens on limited staff resources.

Puget Sound Water Quality Authority Wetlands Protection Plan

The Puget Sound Water Quality Authority (PSWQA) has developed a wetlands protection plan for the Puget Sound counties which includes the following elements:

- *criteria development;*
- *wetland identification;*
- *a wetland preservation program;*
- *state rules for wetland protection;*
- *local program development;*
- *a program to protect wetlands on state-owned lands;*
- *a wetlands education program;*
- *and a wetlands restoration plan.*

The last element was added as a result of EPA review of the draft plan (see "Diked Wetlands Study" below).

EPA staff are serving on advisory committees for the development of wetlands evaluation criteria and the development of standards and guidelines for local governments to use in protecting wetlands. Most elements of the plan are to be implemented by 1990. It appears that the implementation of the PSWQA wetland protection plan will provide models for wetland protection efforts for all Washington local governments.

Diked Wetlands Study

Region 10 has underway a study of the restoration potential of diked wetlands in the estuaries of Washington and Oregon. The second phase of this study (to be conducted in FY 89) will narrow the scope of the search for potential restoration sites to selected areas in Puget Sound. This effort will coincide with the PSWQA wetlands restoration element in their Wetlands Protection Plan. The goal of this effort is to identify diked areas which were formerly a part of the estuary and which have a high potential for restoration to estuarine marshes by dike breaching or tidegate removal. These areas would be eligible for selection by the state Departments of Ecology or Wildlife for purchase or protection by other means (e.g., conservation easement). It is also possible that these areas could be purchased by private land protection agencies.

The reason for interest in this issue is that it provides an opportunity to restore some of the thousands of acres of diked tidelands that have been lost to the estuaries. With proper support, the effort could start us on the path to fulfilling a major goal of the Clean Water Act, to restore waters of the U.S., by regaining wetlands instead of merely holding the line or minimizing losses.

State 401 Certification

Region 10 EPA has been attempting to persuade the states in our region to use the 401 certification process to better protect wetlands. The certification process would work toward this end if the states recognized wetlands as waters of the state, identified beneficial uses for those waters, and protected those uses through regulations. In order to facilitate the implementation of such a program, we have requested a person (and funding) to assist the states in developing water quality standards for wetlands. Such standards would of necessity be qualitative in nature but could be used effectively in the 404 permitting process to protect wetland resources.

Mitigation

Region 10 EPA continues to use its 1985 mitigation policy to reach a goal of no net loss of wetland functions and values for 404-permitted projects in Region 10. This goal is being applied in Washington, Oregon, and Idaho, but is currently not attainable in Alaska. Our wetland protection efforts in Washington have been boosted recently by the adoption of a similar wetland mitigation policy by the Washington Department of Wildlife.

It is now routine for applicants to propose mitigation for all projects with more than minimal adverse environmental impacts. In addition, the mitigation plans presented are more comprehensive and provide for a more complete replacement of wetland functions and values.

EPA (Corvallis Lab) will be issuing a report in FY89 which will provide the first comprehensive, scientifically valid assessment of the success of mitigation efforts on a nationwide basis. Several Washington and Oregon mitigation sites will be included in the study. This study should provide the scientific basis for requiring more thorough mitigation plans. The study should also provide evidence to support EPA staff in requiring applicants to conduct a thorough alternatives analysis in an attempt to avoid wetland impacts, as mitigation is almost never completely successful and even when it is, there is almost always a net loss of wetland functions.

Dredged Material Disposal: Section 404 and Ocean Dumping

Region 10 EPA personnel have been actively involved with the state agencies and Corps of Engineers Districts in managing dredged material disposal. The most active programs have involved the Seattle District for the Puget Sound Dredge Disposal Analysis (PSDDA) and Grays Harbor Navigation Improvements on Ocean Disposal Site Designation; Portland District for several Ocean Disposal Site Designation efforts, a Long Term Management Strategy (LTMS) study for the Lower Columbia River Navigation Channel, and development of Sediment Evaluation and Management Procedures (with the State of Oregon); and Walla Walla District for the Lower Granite Reservoir Navigation and Flood Control interim study.

In related efforts, Wetlands Protection Section personnel have provided technical assistance to other EPA programs for managing existing and future marine Superfund sites (Commencement Bay, Eagle Harbor, etc.) and voluntary clean-up of contaminated sediments (Simpson project in Tacoma, WA; PGE PCB Spill in Portland, OR; and Copper Concentrate Spill in Vancouver, WA). Another related effort involves providing technical assistance to the State of Washington Department of Ecology for developing sediment quality standards as required by the Puget Sound Water Quality Plan.

PSDDA has been a high priority effort. Draft and Final environmental impact statements (EIS) with multiple volume technical appendices were completed for the Central Basin of Puget Sound (Phase I Area). Seattle District is currently preparing the Record of Decision which will implement PSDDA as a regulatory procedure. Region 10 is expected to sign the ROD with the Corps. Disposal sites in the Phase I Area were identified, evaluated and designated under the 40 CFR 230.80 advance identification (ADID) process in FY88.

The ADID process is also being used to designate appropriate in-water disposal sites in the PSDDA Phase II Area (North and South Puget Sound) and will be completed in FY89. As part of the ADID efforts, evaluation procedures and interpretive guidelines for the disposal of dredged material and procedures for management of the designated disposal sites were developed. Efforts are underway to refine the evaluation procedures. Inquiries regarding the PSDDA program have been received from other states (e.g., Oregon) and nations (Canada).

The LTMS study for the Lower Columbia River navigation project has potential for coordinating dredged material management in this interstate water.

Although narrowly scoped to address disposal needs in the main federal navigation channel, the LTMS is providing a focus for multiple agency development of innovative solutions to ongoing and anticipated dredged material problems. Many of the solutions that would be developed for the LTMS are expected to be applicable to other dredging projects in the area. The LTMS effort is scheduled for completion in early FY90.

Separate efforts are underway with the Portland District and Oregon Department of Environmental Quality (ODEQ) to establish sediment quality evaluation procedures for the state. Coordination with ODEQ is ongoing. An initial workshop occurred in late June; additional discussions are scheduled in early FY89 to develop a schedule and set priorities. The Corps, ODEQ, and Oregon Ports Association have expressed interest in conducting joint or coordinated studies that would fill information gaps regarding Oregon sediments. Sediment quality knowledge and concerns in Oregon are less defined than in Washington, where the Washington Department of Ecology (Ecology) has been tasked with developing sediment quality standards. Coordination is occurring between the two states and developments in one program are shared with the other. EPA is facilitating this exchange.

Designation of ocean dredged material disposal sites (ODMDS) will take higher priority in FY89. During FY88, EPA worked with the Corps' North Pacific Division to develop a regional Memorandum of Understanding (MOU). The MOU will be signed in early FY89 and, among various procedural understandings, establishes a schedule for provision of site evaluation information from the Districts to be published as EISs by EPA to support site designations. Following site designation by formal rule, EPA and the appropriate Corps District will develop management plans for the site that will specify operational constraints as well as monitoring requirements. Site designation rules for Nome, AK, Grays Harbor, WA, and Coquille River, OR are expected to be published in early FY89. Permit activity associated with ocean disposal of dredged material is expected to increase as other disposal options are exhausted.

We are currently in the process of evaluating the possibility of ocean disposal of municipal incinerator ash from the community of Akutan, Alaska. The volume of ash is very low (approximately 250 cubic yards per year) and upland disposal opportunities are limited. However, the ash is contaminated with heavy metals and dioxin and its disposal in the ocean could set a precedent which would lead to unintended adverse environmental consequences. As a result, we are evaluating the suitability of this ash from a chemical and biological perspective. We will receive complete chemical bioassay and bioaccumulation study data early in FY 89. Region 10 may prepare a supplemental environmental impact statement in FY 89 based upon these studies (as well as an updated economic analysis). The decision to designate an ocean disposal site and permit the dumping of ash will then be made by EPA Headquarters.

Figure 5.1: Washington S.404 Wetland Losses

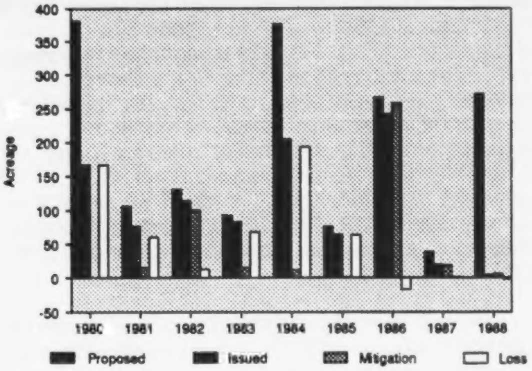


Figure 5.2: Washington S.404 Wetland Losses
By Type

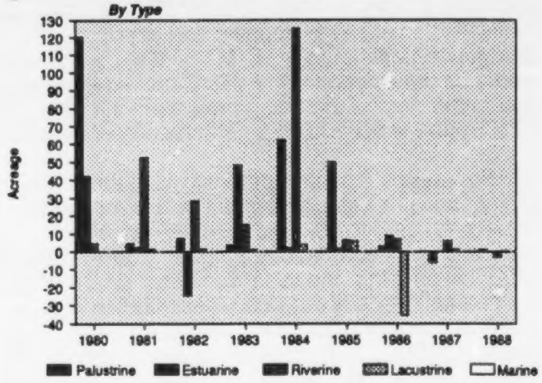


Figure 5.3: Total S.404 Wetland Losses in Washington
By Year

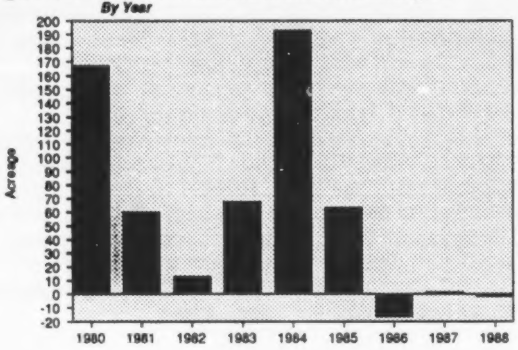


Figure 5.4: Washington Palustrine S.404 Wetland Losses

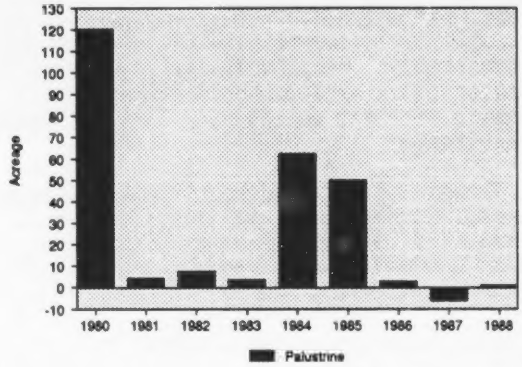


Figure 5.5: Washington Estuarine S.404 Wetland Losses

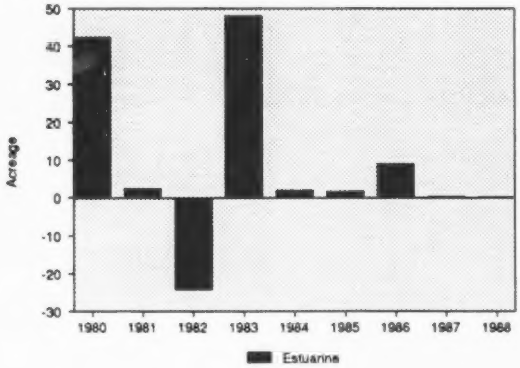


Figure 5.6: Washington Riverine S.404 Wetland Losses

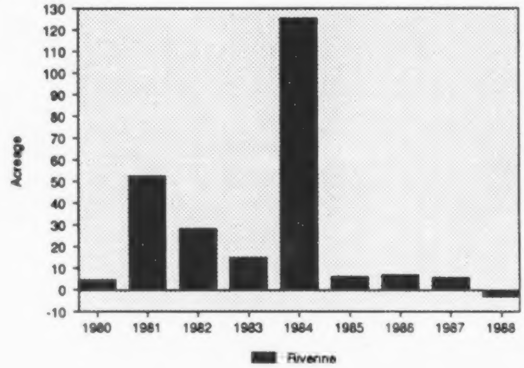


Figure 5.7: Total S.404 Wetland Losses in Washington

By Year

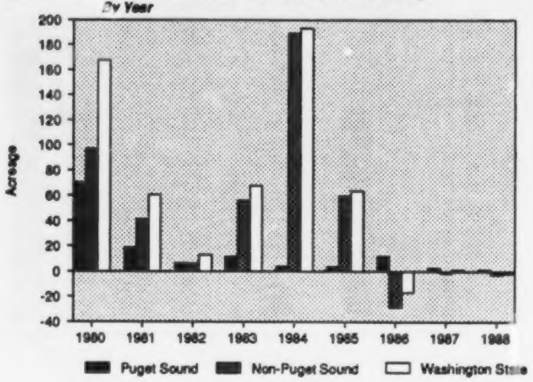


Figure 5.8: S.404 Puget Sound Wetland Losses

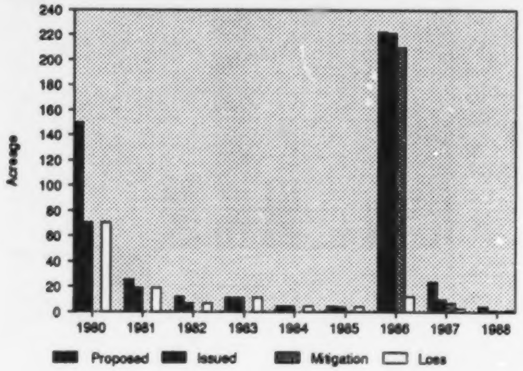


Figure 5.9: Puget Sound S.404 Wetland Losses

By Type

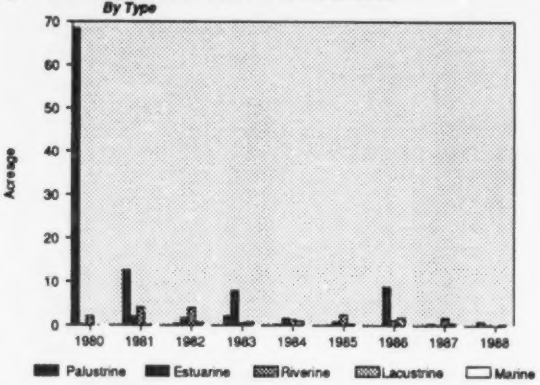


Figure 5.10: Total S.404 Wetland Losses in Puget Sound

By Year

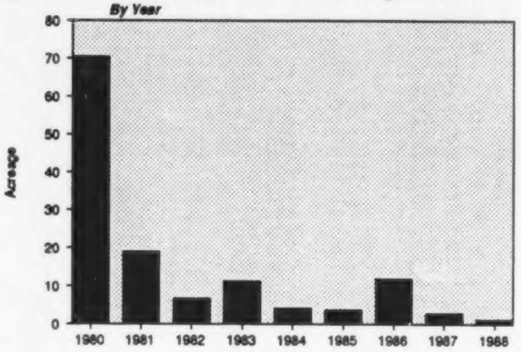


Figure 5.11: Non-Puget Sound S.404 Wetland Losses

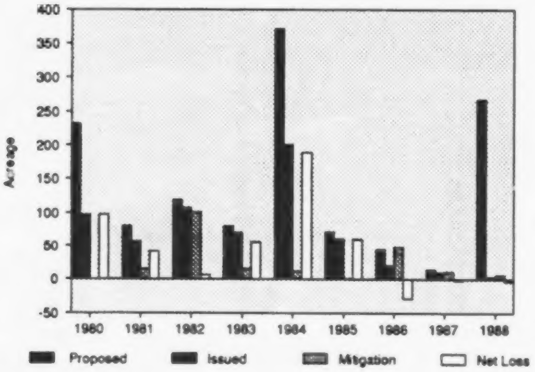


Figure 5.12: Non-Puget Sound S.404 Wetland Losses

By Type

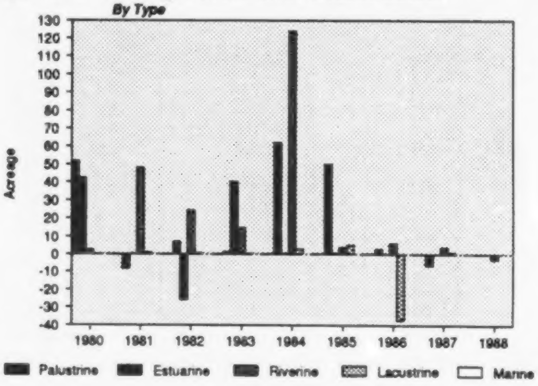


Figure 5.13: Total S.404 Wetland Losses in Washington
Outside of Puget Sound

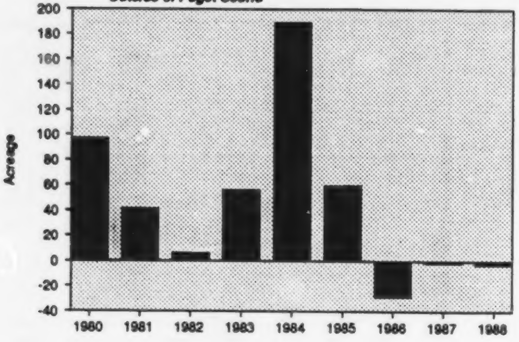


Figure 5.14: S.404 Wetlands Losses Avoided Due To EPA Objections or Conditions

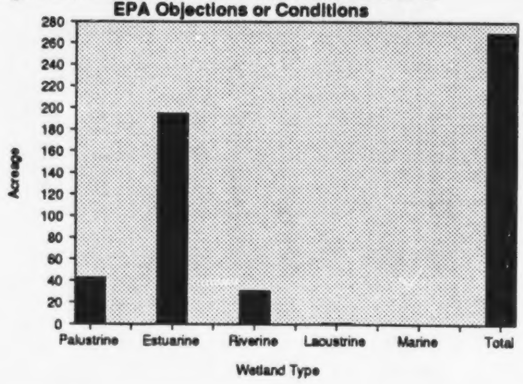


Figure 5.15: Washington Shoreline Affected Through S.404 Impacts

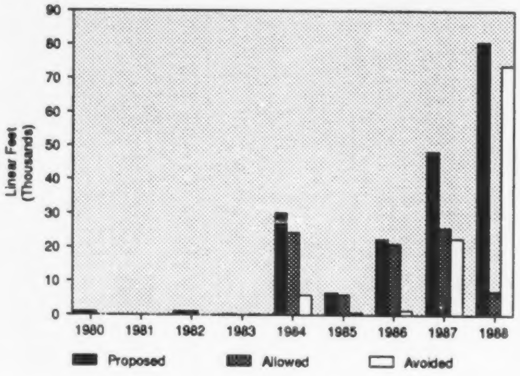


Figure 5.16: Alaska S.404 Wetlands Affected and Avoided

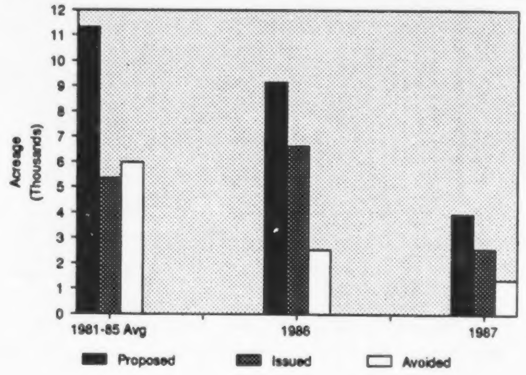


Figure 5.17: Alaska S.404 Wetland Loses

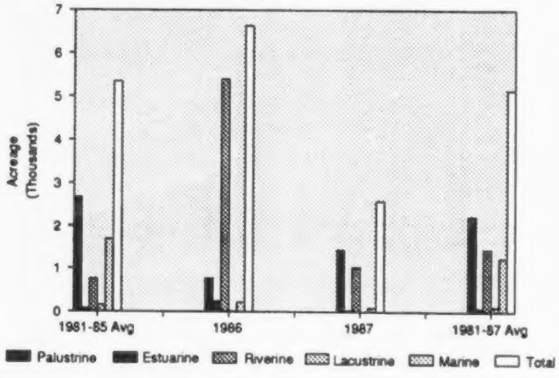


Figure 5.18: Alaska S.404 Wetland Losses

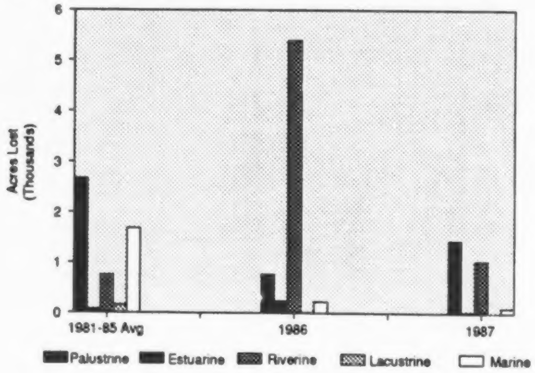


Figure 5.19: Alaska S.404 Wetland Losses 1981-1987

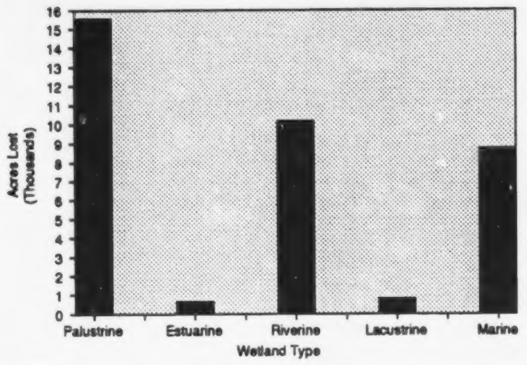


Figure 5.20: Alaska S.404 Palustrine Wetland Losses

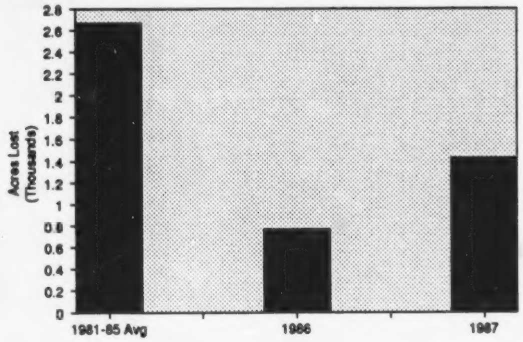


Figure 5.21: Alaska S.404 Estuarine Wetland Losses

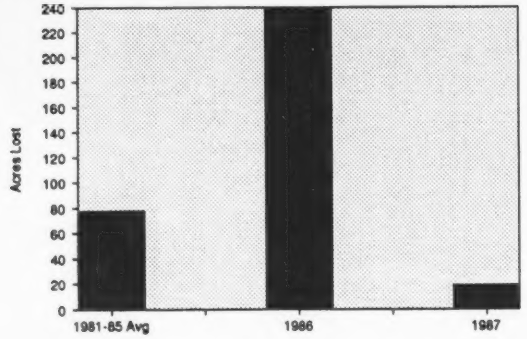


Figure 5.22: Alaska S.404 Riverine Wetland Losses

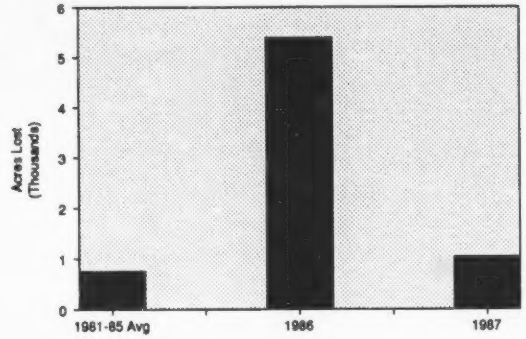


Figure 5.23: Alaska S.404 Lacustrine Wetland Losses

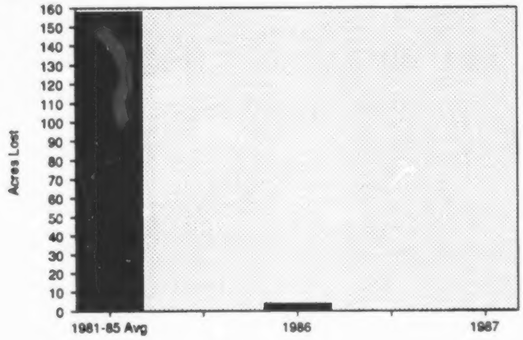


Figure 5.24: Alaska S.404 Marine Wetland Losses

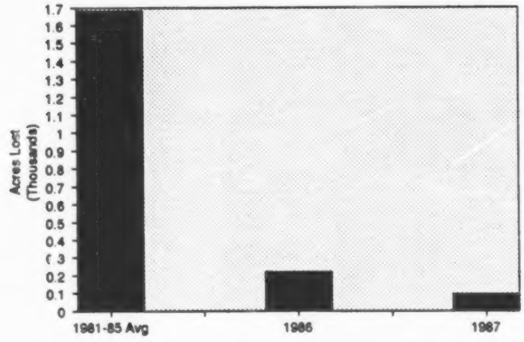
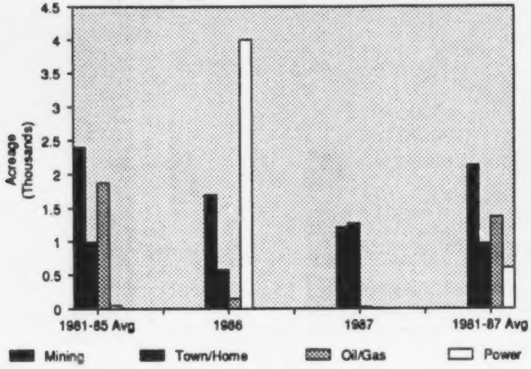


Figure 5.25: Alaska S.404 Wetlands Affected
By Activity Type



Tables 5.1-5.5

Table 5.1
Washington Wetland Losses by Type

	1980	1981	1982	1983	1984	1985	1986	1987	1988	Total
Palustrine	120.37	4.43	7.4	3.6	62.3	50.1	2.77	-6.1	0.9	245.77
Estuarine	42.3	2.34	-24.25	48.07	1.89	1.63	8.95	0.16	0.05	81.14
Riverine	4.64	52.47	28.32	14.95	125.11	6.28	7.06	5.67	-2.9	241.6
Lacustrine	0.11	1.16	1.32	1	3.77	5.62	-35.29	1.46	0.28	-20.57
Marine	0.02	0	0	0	0	0	0	0.01	0	0.03
TOTAL	**167.44**	**60.4**	**12.79**	**67.62**	**193.07**	**63.63**	**-16.51**	**1.2**	**-1.67**	**547.97**

Table 5.2
Washington Wetland Losses

	1980	1981	1982	1983	1984	1985	1986	1987	1988	Total
Proposed	381.52	105.92	131.05	91.81	375.89	76.18	267.14	38.74	271.94	1740.19
Issued	167.44	75.9	114.09	82.72	205.27	64.73	241.91	20.12	4.59	976.77
Mitigation	0	15.5	101	15.1	12.2	1.1	258.42	18.92	6.26	428.5
Net Loss	**167.44**	**60.4**	**13.09**	**67.62**	**193.07**	**63.63**	**-16.51**	**1.2**	**-1.67**	**548.27**

Table 5.3
Total Wetland Losses in Washington

	1980	1981	1982	1983	1984	1985	1986	1987	1988	Total
Puget Sound	70.55	18.97	6.64	11.34	4.13	3.73	11.91	2.72	1.17	131.16
Non-Puget Sound	96.89	41.43	6.15	56.28	188.94	59.90	-28.42	-1.52	-2.84	416.81
All Washington	**167.44**	**60.40**	**12.79**	**67.62**	**193.07**	**63.63**	**-16.51**	**1.20**	**-1.67**	**547.97**

Table 5.4
Puget Sound Wetland Losses by Type

	1980	1981	1982	1983	1984	1985	1986	1987	1988	Total
Palustrine	68.37	12.63	0.4	2.2	0.2	0.1	0	0.4	0.9	85.2
Estuarine	0.05	2.02	1.61	8	1.61	0.91	8.9	0.03	0.05	23.18
Riverine	2.12	4.19	4.02	0.44	1.31	2.4	1.16	1.86	0	17.5
Lacustrine	0.01	0.13	0.61	0.7	1.01	0.32	1.85	0.43	0.22	5.28
Marine	0	0	0	0	0	0	0	0	0	0
TOTAL	**70.55**	**18.97**	**6.64**	**11.34**	**4.13**	**3.73**	**11.91**	**2.72**	**1.17**	**131.16**

Table 5.5
Puget Sound Wetland Losses

	1980	1981	1982	1983	1984	1985	1986	1987	1988	Total
Proposed	149.60	25.75	11.95	11.35	4.53	4.44	222.40	23.75	4.32	458.09
Issued	70.55	18.97	6.64	11.34	4.13	3.93	221.70	9.92	1.33	348.51
Mitigation	0.00	0.00	0.00	0.00	0.00	0.20	209.79	7.20	0.16	217.35
Net Loss	**70.55**	**18.97**	**6.64**	**11.34**	**4.13**	**3.73**	**11.91**	**2.72**	**1.17**	**131.16**

Chapter 5: Wetlands

Tables 5.6-5.10

Table 5.6
Non-Puget Sound Wetland Losses by Type

	1980	1981	1982	1983	1984	1985	1986	1987	1988	Total
Palustrine	52	-8.2	7	1.4	62.1	50	2.77	-6.5	0	160.57
Estuarine	42.25	0.32	-25.86	40.07	0.28	0.72	0.05	0.13	0	57.96
Riverine	2.52	48.28	24.3	14.51	123.8	3.88	5.9	3.81	-2.9	224.1
Lacustrine	0.1	1.03	0.71	0.3	2.76	5.3	-37.14	1.03	0.06	-25.85
Marine	0.02	0	0	0	0	0	0	0.01	0	0.03
TOTAL	**96.89**	**41.43**	**6.15**	**56.28**	**188.94**	**59.9**	**-28.42**	**-1.52**	**-2.84**	**416.81**

Table 5.7
Non-Puget Sound Wetland Losses

	1980	1981	1982	1983	1984	1985	1986	1987	1988	Total
Proposed	231.92	80.17	119.1	80.46	371.36	71.74	44.74	14.99	267.62	1282.1
Issued	96.89	56.93	107.45	71.38	201.14	60.8	20.21	10.2	3.26	628.26
Mitigation	0	15.5	101	15.1	12.2	0.9	48.63	11.72	6.1	211.15
Net Loss	**96.89**	**41.43**	**6.45**	**56.28**	**188.94**	**59.9**	**-28.42**	**-1.52**	**-2.84**	**417.11**

Table 5.8
Alaska Wetland Trends

	1981-85 AVE	1985	1987	1981-87
Palustrine	2668.20	770.80	1431.33	2220.45
Estuarine	77.80	239.34	18.70	92.43
Riverine	753.80	5394.66	1033.70	1456.77
Lacustrine	158.00	3.89	0.12	113.43
Marine	1683.00	219.20	95.48	1247.10
TOTAL	**5340.80**	**6627.89**	**2579.33**	**5130.18**

Table 5.9
Alaska Wetlands Affected and Avoided

	1981-85 AVE	1986	1987	TOTAL
Proposed	11316.6	9165.07	3956.33	69704.4
Issued	5340.8	6627.88	2579.33	35911.21
Avoided	5975.8	2537.19	1377	33793.19

Table 5.10
Alaska Wetlands Affected by Activity Type in Acres

	1981-85 AVE	1985	1987	1981-87 AVE
Mining	2397.60	1699.22	1210.29	2128.22
Town/Home	991.20	579.93	1265.96	971.70
Oil/Gas	1879.00	145.58	22.14	1366.10
Power	45.00	4003.46	4.67	604.73
TOTAL	**5312.80**	**6428.19**	**2503.06**	**5070.75**

Table 5.11

Table 5.11
Washington Wetlands Affected–Most Active Counties

Puget Sound Counties	Permits Issued	Palustrine	Estuarine	Riverine	Lacustrine	Total
King	767	230.67	24.65	4.78	4.05	264.15
Kitsap	113	4.31	0.01	0	0	4.32
Pierce	101	5.11	0	7.16	2	14.27
San Juan	74	1	0	0	0	1
Mason	66	2.11	0.04	0.12	0	2.17
Thurston	63	8.31	0	0	0	8.31
Clallam	49	1.31	0.16	3.11	0	4.58
Jefferson	43	2	0.01	1.41	0	3.42
Skagit	45	0.2	0	0.12	0	0.32
Whatcom	43	3.52	0	0.1	0.26	3.88
Snohomish	43	16.01	2	0.14	0.01	18.16
Island	29	0	10.01	0.1	0	10.11
Subtotal	**1436**	**274.55**	**36.88**	**17.04**	**6.32**	**334.79**
Non-Puget Sound Counties						
Chelan	131	2.31	0	13.46	8.27	24.04
Grays Harbor	88	57.2	121.27	4.63	0	183.1
Pacific	50	13.97	1.05	5.9	0	20.92
Cowlitz	48	10.6	0	108.06	0	118.66
Grant	37	4	0	11.73	1.45	17.1
Walla Walla	32	3	0	30.29	0	33.2
Clark	29	0.4	0	5.45	0.02	5.8
Wahkiakum	28	3	0.6	2.55	0.01	6.1
Benton	26	0	0	5.86	0.05	5.9
Yakima	25	5.2	0	4.14	0	9.3
Douglas	13	1	0	26.66	0	27.6
Subtotal	**507**	**100.68**	**122.92**	**218.73**	**9.8**	**452.1**
TOTAL	**1943**	**375.23**	**159.8**	**235.77**	**16.12**	**786.9**

Wetlands Environmental Indicators FY 89 and Beyond

The following are the environmental indicators which will be included in the FY 89 report. Each of the indicators will be presented in terms of individual states or other geographical location.

1. **Acres of wetland lost in total and by type**
2. **Acres of wetland impacted**
3. **Acres of wetland losses mitigated**
4. **Acres of wetland gains as a result of mitigation and comparison of wetland type lost to type gained**
5. **Acres of wetland impacted and mitigated for by project type (i.e., docks and piers, filling for bank stabilization, etc.)**
6. **Acres of wetland saved due to project modification, permit denial or withdrawal**
7. **Number of permits denied as a result of EPA comments**
8. **Linear feet of shoreline impacted**
9. **Cubic yards of dredged material deposited in-water in Columbia River and Puget Sound**
10. **Cubic yards of dredge material deposited upland from Columbia River and Puget Sound**
11. **Time expenditure of EPA personnel on major and minor wetland projects**
12. **Percentage of projects on which EPA made substantive comments**
13. **Number of enforcement actions and number of resolutions**
14. **Acres of wetland preserved or replaced as a result of enforcement action**

The report will also include discussions covering the status of wetland programs and future directions.

The activities required to obtain the environmental indicators and prepare the FY 89 report are as follows:

1. **Enter Alaska data and re-enter data for Washington and Idaho (which was lost in September 1988) into computer database and analyze data.**

   The task of entering backlog Alaska data will require a significant workload. This may be ongoing beyond September 1989. However, environmental indicators can be developed this year as they were last year by using National Marine Fisheries Service data.

2. **Update FY 88 data analysis with information on project outcomes (i.e., permits issued, denied, conditions incorporated) by coordinating with Corps districts.**

3. **Conduct quality control on database.**

4. **Evaluate OWAS data.**

Chapter 6: Ground Water

Ground Water Environmental Indicators FY 88, FY 89 and Beyond

1. Drinking Water Quality Indicators

- Number and percent of ground-water based public water systems in violation of Maximum Contaminant Levels (MCLs) or reporting requirements for chemical data
- Population at risk from public water systems in violation of MCLs or reporting requirements
- Percent of drinking water and monitoring wells with nitrates above a level of concern (6 mg/l NO_3). (This indicator measures longer term trends and will be repeated again in 1990.)

2. Hazardous Waste Indicators

- Site characterization status and number of sites with ground-water and drinking water contamination above a health advisory or MCL
- Population at risk from contaminants approaching and in drinking water wells

3. Pesticides Indicators

- Number of leachable, active ingredients in pesticides products registered for use in Washington, Idaho and Oregon and the number registered nationally
- Results of state and national pesticides sampling surveys will be evaluated for use in FY 89. Surrogate measures of the quantity of leachable pesticides in use in vulnerable ground-water areas is still under review and will be considered for use as an additional measure after 1990.

4. Underground Storage Tank Indicators

- Number and percent of corrosion-protected tanks in use
- Number of leaking tank cleanups initiated and controlled

Introduction

In 1987, EPA Region 10 began an effort to develop environmental indicators. These indicators, compiled yearly, are intended to provide a means of evaluating the progress of environmental protection and remediation efforts. The Fiscal Year 1987 indicators compilation comprised the initial effort. On the basis of that experience, the new Fiscal Year 1988 indicators have been modified and enhanced, to achieve the goal of attaining a meaningful measure of progress. The overall progress of ground-water protection and remediation efforts will be judged by comparing data summarized in subsequent years with data of the first two years.

The Region 10 Ground-Water Task Force devised the initial ground-water indicator system. Office of Ground Water has since assumed responsibility for continued compilation and evaluation of the indicators.

Separate indicators were developed for drinking water, hazardous waste (CERCLA, RCRA, and Federal facilities), pesticides, and underground storage tanks. These indicators have been modified to varying degrees this year, to render them more useful and effective. The following is a detailed description of the new 1988 indicators, discussions of the changes made from 1987 and the perceived limitations of each indicator. Various tables, charts, and graphics, which summarize the actual indicator data, are included in the text.

1. Drinking Water Environmental Indicators

Description

The 1987 Ground-Water/Drinking Water Environmental Indicator consisted of three components:

(1) a tabulation of the numbers and percentages of ground-water based public water systems with Maximum Contaminant Level (MCL) violations reflective of ground-water quality;
(2) a tabulation of population figures corresponding to the systems with violations; and
(3) a retrieval from the Region 10 STORET water quality database of all wells with nitrate levels greater than 6 mg/l.

In 1988, the MCL violations data and population at risk data compilations were performed, but the STORET nitrate data retrieval was deferred to future years as a long term trend measure.

For the compilation of MCL violations, data on four types of contaminants were tabulated. These categories were nitrates, metals, solvents, and pesticides. The MCL violation information was derived from two sources: the Region 10 portion of the Federal Reporting Data System (FRDS), and "State Follow up on Significant Non-Compliers and Exceptions" (SNC) reports, submitted to EPA from state agencies. The number of systems in violation in each category, and the percentage of systems with violations in these categories of MCLs, (along with corresponding population at risk figures) are presented in Table 6.1. The specific types of violations are detailed in Table 6.2.

The numbers of systems not reporting, and the respective populations served, are detailed in Table 6.3. Conceivably, the populations served by these non-reporting systems could be considered at risk, as there are no available data indicating otherwise. Figure 6.1 presents a summary comparison of 1987 and 1988 indicator data. It displays the numbers of systems not reporting chemical monitoring data, the number of systems that have actual MCL violations, as well as the total numbers of ground-water based systems. Population at risk figures for 1987 and 1988 are shown in Figures 6.2 and 6.3. The populations served (1987 and 1988) by non-reporting systems are shown in Figure 6.4. These have been deemed potentially at risk because there are no data indicating otherwise.

The third category of the drinking water environmental indicator is the nitrate indicator. In 1987, the EPA STORET database was searched to reveal the number of wells in Region 10 with nitrate levels above 6 mg/l. An equivalent search was conducted during August 1988, and no significant differences in data were revealed. The 1988 data are presented in Table 6.4 and show a significant number of locations within Region 10 where ground water exceeds the drinking water MCL for nitrate. In an even larger number of locations, the nitrate concentrations are approaching a level of concern. Minor changes in the number of wells in each nitrate category are due to elimination of obvious non-domestic wells, which was not done in 1987. No new nitrate data were added to STORET during the period between compilation of the 1987 and 1988 data.

Limitations

There are numerous limitations to the use of the MCL violations data. These are:

- The data only represent public water systems. Private wells, irrigation wells, monitoring wells, etc., are not included in the data base.
- Contaminant violations are reported on samples taken at the point of distribution to the water utility customer, not from the source of supply. Use of this data therefore entails assuming that contaminants noted are present in the ground water and not added during water treatment, storage or distribution. This may not be a valid assumption for some of the constituents summarized, such as lead, which might be introduced from water system plumbing.
- Not all systems are reporting data on a regular basis (see Table 6.3).
- Ground-water contamination at concentrations less than the MCL, but significantly above detection levels, are not reported to EPA by the state and are not readily available for assessment.
- Most ground-water public water supply systems have not, in the past, been required to sample for synthetic organic compounds, or pesticides. Therefore, absence of violations in these categories does not mean an absence of systems contaminated with these compounds.
- There are occasionally discrepancies between data obtained from FRDS and data obtained from SNC reports. These are usually due to delays or time lags in updating each of these data summaries.
- There are limitations to the use of the nitrate STORET retrieval indicators data. No new data were entered into STORET during the 1987-1988 period.

Future Directions

Future summaries of MCL violations data will be more revealing of contamination by synthetic organic compounds and pesticides, because ground water systems will be required to sample for more of these compounds (under provisions of the Safe Drinking Water Act Amendments of 1986). Future compilations of MCL violations information should encompass (and identify) all appropriate types of MCL violations, specifying both numbers of violations and numbers of systems with violations. This is the method prescribed in the new EPA headquarters draft publication entitled ***Indicators for Measuring Progress in Ground-Water Protection*** (Office of Ground-Water Protection, EPA 440/6-88-006, November 1988). This will allow any reader to make an independent judgment of the importance of any particular MCL violation. The Region 10 compilation of ground-water environmental indicators will track the methods finally adopted by the national program and use those appropriate for Region 10.

Because of the sporadic and gradual rate of entry of nitrate data into STORET, it would be appropriate to reduce the frequency of the presentation of this data. Accordingly, this indicator will be eliminated this year and will be compiled only every three years in the future.

Table 6.1
Drinking Water MCL Violations in Ground-water Based Drinking Water Systems

State	Total No. of GW Systems	Systems w/ MCL Violations	Percent Systems w/ Violations	Population at Risk*
Alaska	1,269	5	0.4	7,683
Idaho	2,591	0	0	0
Oregon	2,615	1	0.04	35
Washington	4,037	19	0.5	40,459
Totals	**10,512**	**25**	**0.2**	**48,177**

* Population served by systems with MCL violations

Table 6.2
Categories of MCL Violations in Ground-Water Drinking Water Systems

State	Types of Violations				
	Nitrates	Metals	Synthetic Organics*	Pesticides	Totals
Alaska	1	4	0	0	5
Idaho	0	0	0	0	0
Oregon	1	0	0	0	1
Washington	18	0	1	0	19
Totals	**20**	**4**	**1**	**0**	**25**

* Includes trihalomethanes

Table 6.3
Ground Water Systems Not Reporting Chemical Data, and Corresponding Population Figures

State	Total No. of GW Systems	No. of Systems Not Reporting*	Percent Systems Not Reporting	Potential Population at Risk
Alaska	1,269	23	1.8	3,620
Idaho	2,591	1	0.04	50
Oregon	2,615	2	0.1	55
Washington	4,037	10	0.2	453
Totals	**10,512**	**36**	**0.3**	**4,178**

* Systems not reporting chemical data
** Population served by systems not reporting chemical data

Table 6.4

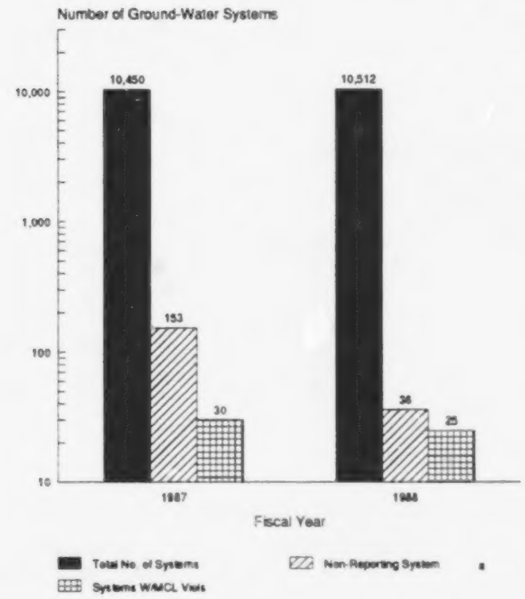
Ambient Ground-Water Quality for Nitrates as Measured by Areawide Sources
(STORET data as of August, 1988 except where noted)

	Approx # Wells In State/Region	NO_3-N* 6 - 10 mg/l	Percent	NO_3-N 10 mg/l	Percent
Alaska	425	2	0.5	2	0.5
Oregon**	3,100	95	3.0	23	0.7
Idaho	1,150	16	1.4	8	0.7
Washington	2,230	69	3.1	40	1.8
Total Region	**6,935**	**182**	**2.6**	**73**	**1.1**

* Includes total NO_3 with appropriate correction factor

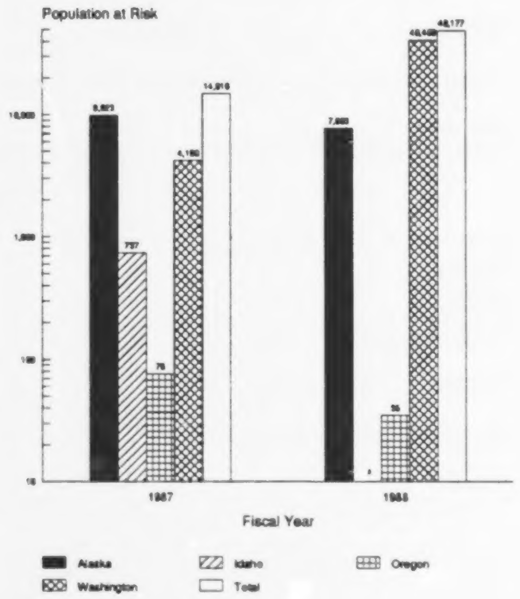
** Includes approximately 2900 wells stored in the Regional Oregon Public Water Supply Database that had been managed by L. Worley (not in STORET)

Figure 6.1
Water Supply Systems with MCL Violations
Or Not Reporting Chemical Data



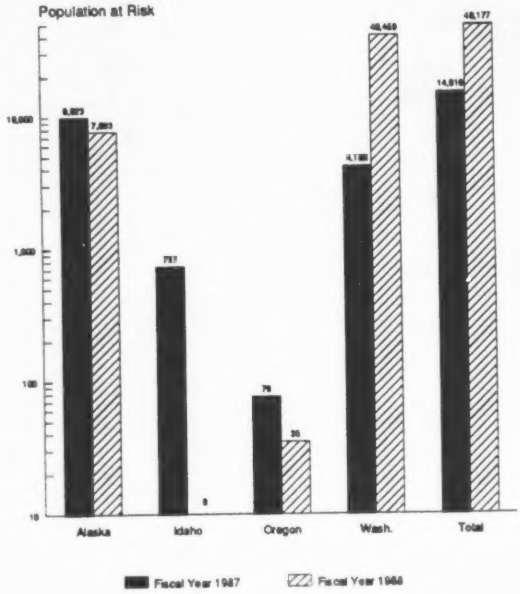
Ground-Water Environmental Indicators:
Drinking Water

Figure 6.2
Population at Risk Due to MCL Violations
Yearly Summary



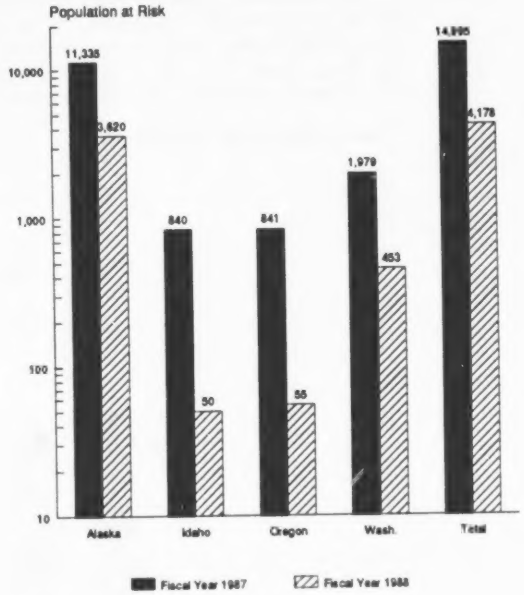
Ground-Water Environmental Indicators:
Drinking Water

Figure 6.3
Population at Risk Due to MCL Violations
State-by-State Summary



Ground-Water Environmental Indicators:
Drinking Water

Figure 6.4
Potential Population at Risk Due to
Non-Reporting of Chemical Data



Ground-Water Environmental Indicators:
Drinking Water

2. Hazardous Waste Environmental Indicator

Description

The ground-water hazardous waste environmental indicator is a classification scheme for all hazardous waste sites and facilities in Region 10. For 1988, RCRA-regulated facilities, Superfund sites, and federal facilities were categorized in one of several ways describing the impact of the site on ground water or ground-water based drinking water supplies. The classification was done by polling all EPA site managers, permit writers, compliance officers, and other Hazardous Waste Division staff familiar with site status. Staff members were asked to complete a questionnaire for each site, describing the nature of contamination (if any) and the population affected by contamination.

Sites or facilities were categorized into only one of five possible categories. These are:

(1) Ground-water investigation conducted;
(2) No ground-water contamination found associated with the site;
(3) Ground-water contamination associated with the site, but no drinking water contamination;
(4) Ground-water contamination associated with the site, but impacts on drinking water supplies unknown; and
(5) Ground-water ***and*** drinking water contamination attributable to the site.

The numbers of sites or facilities that fall into each of these categories are summarized in Table 6.5.

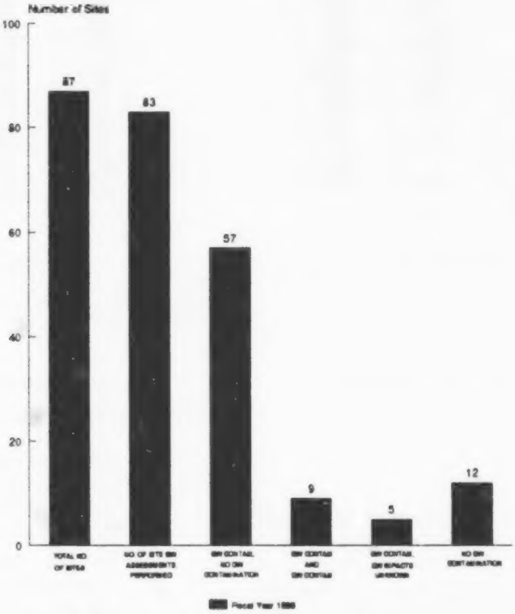
Table 6.5

Ground-Water Contamination Status for Region 10 CERCLA, RCRA and Federal Facilities

Category	Number of Sites
A. Ground-water assessments performed	83
B. No ground-water contamination associated with site	12
C. Ground-water contam.; no drinking water contam.	57
D. Ground-water contam.; drinking water impacts unknown	5
E. Ground-water contam. and drinking water contamination	9
Total Number of Sites	**87**

Figure 6.5

Site Ground-Water Contamination Status



Ground-Water Environmental Indicators:
Hazardous Waste Sites

The results of the tabulation summarized in Table 6.5 are also depicted graphically in Figure 6.5. Data for 1989 and beyond will be added to this figure over the next few years. A more detailed summary of the site categorization results is given in Table 6.6. This depicts the number of sites at which contamination is judged severe (i.e., contaminants present in levels above a health advisory or drinking water standard), along with an approximation of the population deemed at risk from consumption of contaminated groundwater.

Table 6.6

Summary of Ground-water Contamination Status for all Region 10 CERCLA, RCRA and Federal Facilities

GW Contamination Status	Number of Sites	Number Sites Above LOC	Population at Risk
Assessment of GW Contamination Done	83		
No Known GW Contamination Associated with Site	12		
GW Contamination Associated with Site; No Drinking Water Contamination	57	33	
GW Contamination Associated with Site; Impact on Drinking Water Unknown	5	3	
Ground Water and Drinking Water Contamination Associated with Site	9	9	> 605,000
Total Number of Sites	87	45	> 605,000

1. Includes proposed and final NPL sites and RCRA regulated Land Disposal Facilities (LDFs)
2. Ground-water contaminants identified above a 'Level of Concern' (LOC) - health advisory or drinking water standard

Limitations

The 1988 ground-water hazardous waste indicator is a significant refinement of the original 1987 indicator. The 1988 indicator is a relational classification scheme, in which all categories are mutually exclusive. This allows unambiguous interpretation of the status of the sites. The 1987 indicator, however, was a hierarchical classification scheme, in which sites were put into groups and subgroups which were not mutually exclusive. The original 1987 indicator data questionnaire allowed too much variability in interpretation and categorization, and resulted in what is now considered to be ambiguous and inconsistent data.

The new 1988 classification scheme avoids the problems associated with the 1987 hierarchical classification. For 1988, the number of site status categories was reduced to five (from seven), to allow a more succinct summary and clear interpretation. This was partly accomplished by eliminating the distinction between on-site and off-site contamination of ground water. The new classification considers all ground-water contamination as equally important. A serious problem with the 1987 tabulation was that for many sites, there was no off-site testing of ground water--but these were categorized as having no off site contamination of ground water. The new 1988 questionnaire includes more specific questions to allow more precise categorization of site status.

Future Directions

Several steps were taken in 1988 to improve the effectiveness of the hazardous waste ground-water environmental indicator. The 1988 questionnaire distributed to Hazardous Waste Division personnel was revised and clarified, to minimize the variability in responses due to differing interpretations. For 1988, the number of categories of site ground-water contamination status was reduced, to simplify the presentation of the information, and to eliminate the distinction between on-site and off-site ground-water contamination. The success of this effort to expedite the data gathering process will be further evaluated in 1989.

3. Pesticides Environmental Indicator

Description

An improved environmental indicator for ground-water contamination from pesticides has been developed that uses September, 1988 data as a starting point. The indicator compares the number of leachable to non-leachable pesticide active ingredients that are contained in pesticide brands registered in Washington, Oregon, and Idaho. (Leachable pesticides are those tested for in EPA's National Pesticide Survey). These brands are registered by the states for commercial uses. This indicator is a measurement of how many leachable pesticides are registered in the three states. Data used for the indicator were easily obtained, and it is expected that such data will be available in future years without extensive use of resources and time. A reduction in the number of leachable active ingredients is interpreted to represent reduced potential for ground-water contamination and less risk to public health through the ground-water/drinking water pathway.

The pesticide indicator uses the Washington State University (WSU), Agricultural Extension Service pesticide data base. This data base lists active ingredients registered by and for use in Idaho, Oregon and Washington. The data on this list were compared to the EPA list of "priority pesticides which are believed to have a high potential for leaching into ground water" (i.e., "leachers") that are on the list of **Pesticides Included in the EPA National Pesticide Survey, April 14, 1988**. Modifications to both lists were necessary in order to compare them.

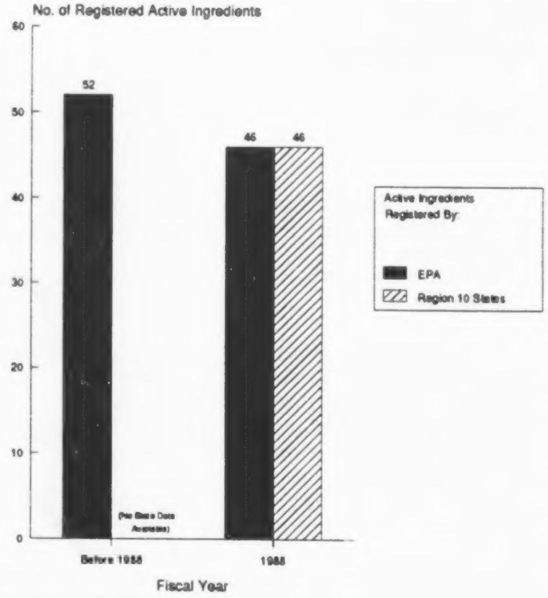
The EPA leachers are listed as active ingredients (AIs), breakdown products, and brandnames (Table 6.7). The primary compound name of the AI and all of its breakdown products are counted together as one AI. For example: aldicarb, aldicarb sulfone, and aldicarb sulfoxide are all grouped together as one AI. "Baygon" is the brand name for the state-registered AI, propoxur. "ETU" is an all-encompassing name for the four AIs, zineb, mancozeb, metriam, and maneb. Dieldren, dinoseb, EDB, 2,4,5-T, 2,4,5-TP, and DBCP have all been cancelled or suspended. Nitrates/nitrites are excluded from the indicator because they are not registered as AI's by the states. Hexachlorobenzene is registered as HCB by the states. Floumeturon is not registered in Region 10, as it is used on sugarcane and cotton which are not grown anywhere in the region.

The WSU list of AIs registered in the region was sorted to include all "commercial" AIs. Insecticides, rodenticides, vertebrate and invertebrate controls, nematicides, fungicides, herbicides, and dessicants/defoliants are included. Disinfectants, slimicides/algicides, and growth regulators are pesticides listed under the commercial category, but are not counted in the indicator because there are no leachers registered for these uses. AIs that begin with the same compound name were treated as one AI (consistent with the EPA list). AIs that begin with the same element were counted as separate AIs. For example: copper carbonate, copper hydroxide, copper 2-ethylhexanoate, and copper sulfate basic are counted separately, for a total count of four AIs. AIs that begin with "oil" are counted as one AI.

A total of 382 AIs are registered by the states with 46 of them being leachers. Thus, in September 1988, all of the AIs that have potential uses in the region, and are registered and considered by EPA to be leachers, are approved for use in the region. A total of the number of AIs registered by EPA could not be obtained because EPA does not categorize registered AIs as commercial, industrial, etc.

Figure 6.6 is a comparison of the number of EPA registered "leachers", and the number of these

Figure 6.6
EPA/State Registered Active Ingredients
With Potential to Leach to Ground Water



Ground-Water Environmental Indicators: Pesticides leachers that are registered by the states of Region 10. In 1988, the numbers are the same (both total 46). The graph also shows a reduction in the number of leachable pesticides registered for use; six AIs were cancelled or suspended by EPA prior to 1988. Comparisons of future years will track the changes in numbers of both of these parameters.

Limitations

The indicator does not give a direct measurement of leachable pesticide use or human health exposure through the ground-water/drinking water pathway. To correlate the number of leachable pesticides registered to a measure of ground-water contamination, an assumption must be made that when the number of registered leachable pesticides changes, the actual amount applied changes, and thus ground-water contamination potential and human health exposure changes.

Future Directions

The ultimate goal of a pesticide indicator should be either to represent actual changes in measurements of pesticide contamination found in ground water, or changes in the quantities of leachable pesticides applied over vulnerable ground-water areas. Historical pesticide use data or ambient quality data are not currently available and are not likely to be available in the future. However, such a study will soon be completed for Oregon, and data from the study may be useful as a future indicator. The state of Washington is also beginning a restricted-use program for pesticides thought to be possible leachers in the state. These data may be also useful as a future indicator.

Data results from the National Pesticide Survey will be available in 1990, but the Survey does not lend itself as an indicator for Region 10 due to the limited sampling sites in this Region. The state of Washington has initiated a pesticide in ground water sampling program in areas where pesticides are considered most likely to be found. Results of sampling in selected areas of this survey could be used as baseline data for subsequent year comparison to determine the impact of the application of BMPs and other actions taken as part of the state's Pesticides in Ground Water Management Plan.

The 1987 indicator that used "Leachable Area" from the EPA study, titled ***"Survey of Pesticides used in Selected Areas Having Vulnerable Ground Water in Washington State"*** was not repeated for 1988 because of the high resource intensive nature of obtaining the necessary data. A new assessment of crop-use for all counties in Washington would need to be conducted each year to have a yearly indicator of this type. Resources are not currently available to produce these yearly assessments, but could be used periodically, i.e., every 5 years.

Table 6.7

Pesticide Active Ingredients Considered as Leachers by EPA Registered for Use in Region 10 In or Before 1988

Aciflourfen
Alachlor
Aldicarb
Ametryn
Atrazine
Bentazon
Bromacil
Butylate
Carbaryl
Carbofuran
Carboxin
Chlordane
Chlorothalonil
Cyanazine
2,4-D Propoxur
*DBCP
Diazinon
Dicamba
Dichloropropene
*Dieldren
*Dinoseb
Diphenamid
Disulfoton
Diuron
*EDB *2,4,5-TP
Endrin
ETU: Maneb
    Mancozeb
    Zineb
    Metriam

Fenamiphos
Heptachlor
Hexachlorobenzene
Hexazinone
Methomyl
Methoxychlor
Metribuzin
Oxamyl
Pichloram
Prometon
Pronamide
Propachlor
Propazine
Propham

Simazine
Tebuthiuron
Terbacil

Terbufos
Trifluralin
*2,4,5-T

* Cancelled or suspended by EPA before 1988

4. Underground Storage Tank Environmental Indicators

Background

The underground storage tank (UST) program is a relatively new program regulating underground storage of hazardous substances and petroleum. It is actually composed of two complementary programs: the UST prevention program, and the leaking UST (LUST) remedial action program.

UST is different from other EPA programs in many aspects. First, the large size of the universe (two million regulated tanks) necessitates that the program be implemented at the state and local levels as much as possible, even from the outset. Also, because over a dozen state programs were already in existence prior to the EPA program, EPA wished to avoid establishing a rigid national program that would disrupt their progress. The program has thus been allowed a great deal of flexibility in both structure and implementation. One result of this flexibility, however, is the absence of a national database. Each state also handles its program very differently, which makes it difficult to find indicators that are uniform across the region, or to compare one state with another. Progress is best measured within each state itself, although regional trends will, hopefully, be discernable as the program matures.

The fact that an UST program of any kind is very new in all Region 10 states, however, allows us a unique opportunity to observe change from the very beginning of the program. Our indicators used for the FY87 baseline data represent the very first UST inventory at any level in Region 10.

Environmental Indicator:
Percentage of Corrosion-Protected USTs

Description

Corrosion of bare steel tanks is a major cause of underground tank releases into the environment. The tank notification (registration) requirements of RCRA Subtitle I provide baseline information on tank type, age, material, size, etc. that can be used as an indicator for the UST prevention program. From these data we can compare the number and percent of bare steel tanks (the likely leakers over time), to that of corrosion-protected tanks (cathodically protected steel, fiberglass, or cement tanks). The various types of corrosion protection are not totally equivalent, but they are all significantly less at risk than bare steel. Tables 6.8, 6.9, and 6.11, 6.13, 6.15, and 6.17 show both aggregate percentages and breakdowns by protection type in the entire region and the individual states.

A partial increase in the number of protected tanks can be measured periodically by accessing state data bases. The number of tanks in the database changes daily as tanks are both removed and added; there is no optimal number of tanks. Thus, the indicator is based on a percentage. An increase in the percentage of the protected, low-risk tanks can serve as one measure of success in achieving program objectives and environmental protection.

Limitations

There are four primary limitations to the use of the UST indicator. First, the database reflects the status of tanks as they were at the time of registration (May 1986). At that time there were no regulations, and very few tanks were protected from corrosion. After the draft regulations were published, tank owners began to upgrade their systems. Many also removed their tanks. Because Headquarters (HQ) viewed this registration as a one-time event, there was no requirement for systems which upgrade or change status to notify the state or EPA of changes. Therefore, the proposed indicator will measure primarily new system additions; it will not reflect the upgrades unless the owner has voluntarily provided this information to the state agency, which is unlikely.

Thus, the number of corrosion-protected tanks is likely to be much higher than the record indicates. This may be a short-lived problem. The lack of an upgrade reporting requirement and other information on the form has led many states to begin revising the form and requiring re-registration of the tanks. (Oregon is already in this process, and that is the reason there are no data available for 1988). Their next year's data should show a dramatic change from 1987 data, once the database revision is completed. The baseline data for 1987 should still be useful in comparing the change.

Second, not all tank owners/operators have complied with notification requirements. In some areas of this region, as many as 50% of the owners are believed to be non-notifiers. Although the notifiers are numerous enough to provide a large sample (approximately 70,000), they may not be representative of the whole universe. The non-notifiers tend to be smaller facilities, particularly non-marketers. These tanks in non-compliance with the notification are also more likely to non-comply with the upgrade requirements, either because they may be ignorant of the requirements entirely, or because they are just not inclined to enter the regulatory system.

Third, because HQ did not wish to establish a national database, states were allowed to develop their own notification form. Each state in Region 10 has chosen to use a similar (but not identical) notification form. Categories were not completely parallel for each state across the region. Thus, it was necessary to compile several categories of tanks on some state forms to produce regional uniformity, and there is a small amount of duplication and uncertainty. Total number of tanks does not, therefore, always exactly match the sum or the categories listed.

Last, a large number of notifiers listed their tank material as "unknown." Since tank protection is generally a relatively recent practice, and most of the unknown tanks are older tanks, we believe it is valid to assume that all tanks listed as unknown are the unprotected, bare steel construction.

Despite these limitations, the wide variation in state programs allows little else with which to measure progress at this time.

Results

The tables compare the indicators in two ways. Tables 6.8 and 6.9, provide an annual comparison of states, and include a regional total. While this provides some interesting contrasts, these data must be viewed with caution because the program is implemented very differently and is at very different stages in each state. It does, however, show that wide variations exist between states.

Tables 6.11, 6.13, 6.15, and 6.17 compare each state to itself for the two years listed. This provides a more balanced measure of progress. It is interesting to note that the percentage of protected tanks in Washington rose rapidly in 1988, *even in the absence of legislation*. The total number of tanks dropped, due partially to tank removals, but mainly to the state purging its database of duplicates and protective filers. Both Idaho and Alaska showed no change in the percentage of protected tanks, although numbers of unprotected tanks actually rose slightly. This is likely due to late notifiers entering the system, although there are undoubtedly still some unprotected tanks being installed.

Future Directions

None anticipated at this time.

Environmental Indicator: *Number of LUST Cleanups*

Description

This year a new indicator, the number of LUST cleanups, has been added for the LUST remedial action program. This number is compiled by the state agencies implementing the Trust Fund program, and consists of both state-lead cleanups and responsible party oversite actions by the state. Table 6.9 includes a summary of the number of cleanups initiated in the Region in 1988. Tables 6.10, 6.12, 6.14, 6.16, and 6.18 give a state by state summary of this indicator. Figure 6.12 presents the status of the total number of cleanup actions "initiated" compared to the number categorized by the states as "controlled."

Limitations

As the LUST program is just starting, a large number of cleanups are occurring that are not being reported to the state, and the numbers shown are likely to be much lower than actual. This indicator is also deceptive, however; it is expected that, as the number of protected tanks in the region increases under the UST portion of the program, the number of future LUST cleanups will first rise dramatically as tanks are upgraded and leaks found, then decrease, as upgrades remove potential sources. Eventually, the optimal number of cleanups should be zero, when the number of protected tanks reaches 100%.

Results

As this is the first year for the LUST indicator, it establishes a baseline, but no comparisons can be made at this time.

Future Directions

None anticipated at this time.

Table 6.8

Number and Percent Protected Underground Storage Tanks, 11/87

	Washington	Oregon*	Idaho*	Alaska	Region 10
Concrete	251 (<1%)	103 (<1%)	27 (<1%)	36 (<1%)	417 (<1%)
Fiberglass	1,664 (5%)	1,043 (5%)	205 (2%)	106 (2%)	3,018 (4%)
Composite	5 (<1%)	1,151 (5%)	124	0	1,156 (<2%)
Cathodic Protection	3,257 (9%)	1,279 (6%)	634 (7%)	309 (7%)	5,479 (8%)
Bare Steel/Unknown	29,625 (85%)	20,448 (89%)	8,580 (91%)	3,977 (85%)	62,630 (87%)
Other	5 (<1%)	538 (2%)	20 (4%)	276 (6%)	839 (<1%)
Total Protected Tanks	**5,177 (15%)**	**3,576 (15%)**	**866 (9%)**	**451 (10%)**	**10,070 (13%)**
Total Unprotected Tanks	**29,630 (85%)**	**24,526 (85%)**	**8,600 (91%)**	**4,253 (90%)**	**67,009 (87%)**
Total Tanks	**34,807**	**28,102**	**9,466**	**4,704**	**77,079**

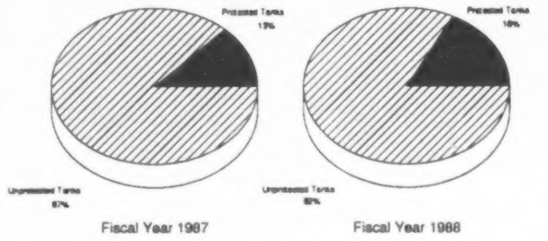
* A few tanks counted twice; fiberglass and fiberglass-coated may be double-counted.

Table 6.9

Number and Percent Protected Tanks, 10/88

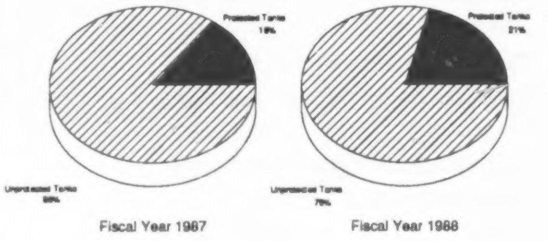
	Washington	Oregon	Idaho*	Alaska*	Region 10
Concrete	249 (<1%)	no data this year (database under revision)	28 (<1%)	36 (<1%)	313 (<1%)
Fiberglass	1,965 (6%)		203 (2%)	111 (2%)	2,279 (5%)
Composite	1,426 (4%)		130 (1%)	35 (<1%)	1,591 (3%)
Cathodic Protection	3,735 (11%)		614 (6%)	321 (6%)	4,670 (9%)
Bare Steel/Unknown	27,538 (79%)		8,657 (91%)	4,475 (89%)	40,670 (82%)
Other	75 (<1%)		49 (<1%)	70 (1%)	194 (<1%)
Total Protected Tanks	7,375 (21%)		845 (9%)	503 (10%)	8,723 (18%)
Total Unprotected Tanks	27,613 (79%)		8,706 (91%)	4,545 (90%)	40,864 (82%)
Total Tanks	**34,988**	**28,102****	**9,551**	**5,048**	**72,887**

Figure 6.7
Protected and Unprotected Underground Storage Tanks - Region 10



Ground-Water Environmental Indicators:
Underground Storage Tanks

Figure 6.8
Protected and Unprotected Underground Storage Tanks - State of Washington



Ground-Water Environmental Indicators:
Underground Storage Tanks

Table 6.10

Total Cleanups Since LUST Program Inception

	Washington	Oregon	Idaho	Alaska	Region 10
Initiated	1	92	9	143	145
Controlled	0	55	4	0	59

* Some fiberglass and fiberglass-coated may be double-counted.
** FY87 Total

Table 6.11

Number and Percent Protected USTs in State of Washington

	1987	1988	1989	1990
Concrete	251 (<1%)	249 (<1%)		
Fiberglass	1,664 (5%)	1,965 (6%)		
Composite	5 (<1%)	1,426 (4%)		
Cathodic Protection	3,257 (9%)	3,735 (11%)		
Bare Steel/Unknown	29,625 (85%)	27,538 (79%)		
Other	5 (<1%)	75 (<1%)		
Total Protected Tanks	5,177 (15%)	7,375 (21%)		
Total Unprotected Tanks	29,630 (85%)	27,613 (79%)		
Total Tanks	**34,807**	**34,988**		

Table 6.12

Total LUST Cleanups Since Program Inception in State of Washington

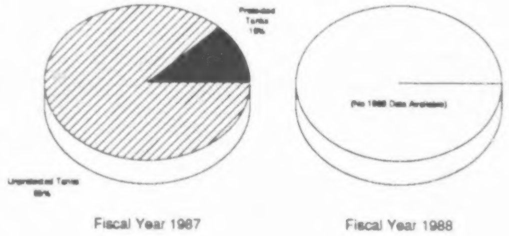
	1987	1988
Initiated	N/A	1
Controlled		0

Table 6.13

Number and Percent Protected USTs in State of Oregon

	1987	1988*	1989	1990
Concrete	103 (<1%)			
Fiberglass	1,043 (5%)			
Composite	1,151 (5%)			
Cathodic Protection	1,279 (6%)			
Bare Steel/Unknown	20,448 (89%)			
Other	538 (2%)			
Total Protected Tanks	3,576 (15%)			
Total Unprotected Tanks	24,526 (85%)			
Total Tanks	**28,102**			

Figure 6.9
Protected and Unprotected Underground Storage Tanks - State of Oregon



Ground-Water Environmental Indicators:
Underground Storage Tanks

Table 6.14

Total LUST Cleanups Since Program Inception in State of Oregon

	1987	1988
Initiated	N/A	92
Controlled		55

* Database is being reorganized; no data available.

Table 6.15

Number and Percent Protected USTs in State of Idaho

	1987*	1988*	1989	1990
Concrete	27 (<1%)	28 (<1%)		
Fiberglass	205 (2%)	203 (2%)		
Composite	124 (1%)	130 (1%)		
Cathodic Protection	634 (7%)	614 (6%)		
Bare Steel/Unknown	8,580 (91%)	8,657 (91%)		
Other	20 (<1%)	49 (<1%)		
Total Protected Tanks	866 (9%)	845 (9%)		
Total Unprotected Tanks	8,600 (91%)	8,706 (91%)		
Total Tanks	**9,466**	**9,551**		

Table 6.16

Total LUST Cleanups Since Program Inception in State of Idaho

	1987	1988
Initiated	N/A	9
Controlled		4

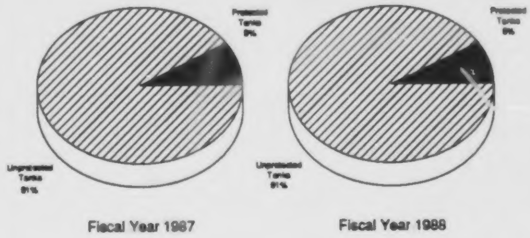
* A few tanks counted twice; fiberglass and fiberglass-coated may be double-counted.

Table 6.17

Number and Percent Protected USTs in State of Alaska

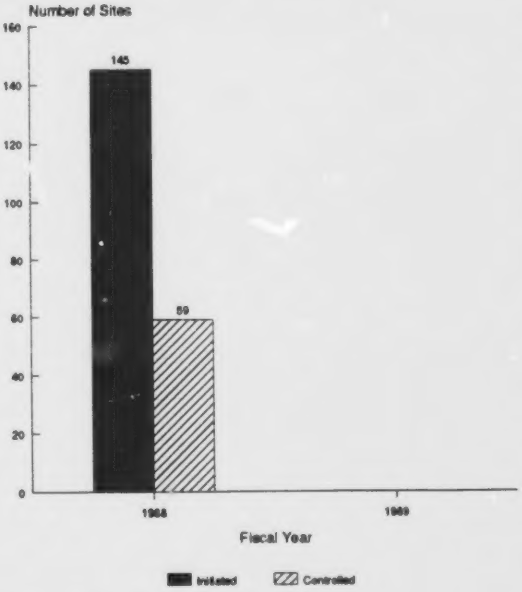
	1987*	1988	1989	1990
Concrete	36 (<1%)	36 (<1%)		
Fiberglass	106 (2%)	111 (2%)		
Composite	0	35 (4%)		
Cathodic Protection	309 (7%)	321 (6%)		
Bare Steel/ Unknown	3,977 (85%)	4,475 (89%)		
Other	276 (6%)	70 (1%)		
Total Protected Tanks	451 (10%)	503 (10%)		
Total Unprotected Tanks	4,253 (90%)	4,545 (90%)		
Total Tanks	4,704	5,048		

Figure 6.10
Protected and Unprotected Underground Storage Tanks - State of Idaho



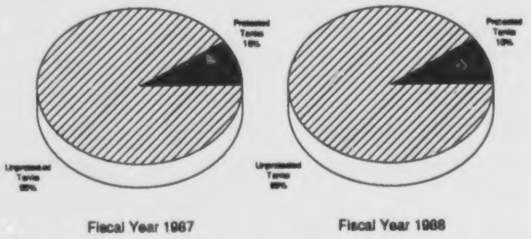
Ground-Water Environmental Indicators:
Underground Storage Tanks

Figure 6.12
Leaking Underground Storage Tanks:
Cleanup Actions



Ground-Water Environmental Indicators:
Underground Storage Tanks

Figure 6.11
Protected and Unprotected Underground Storage Tanks - State of Alaska



Ground-Water Environmental Indicators:
Underground Storage Tanks

Table 6.18

Total LUST Cleanups Since Program Inception in State of Alaska

	1987	1988
Initiated	N/A	43
Controlled		0

* A few tanks counted twice; fiberglass and fiberglass-coated may be double-counted.

Chapter 6: Ground Water

Summary

Data were tabulated for four environmental indicators for ground water for 1988. These indicators, originally developed during 1987, represent both area-wide and site-specific measures. Various modifications were made in the indicators in response to detailed evaluation of the original 1987 compilation. The following is a description of the four indicators, along with discussion of the changes made in the 1988 compilation, and a brief summary of the trends evidenced from 1987 to 1988.

Drinking Water Quality Indicator

Characteristics:

- Number and percent of public water systems in violation of MCLs
- Population at risk from public water systems in violation of MCLs

Changes:

- The nitrate contamination indicator (percent of drinking water and monitoring wells with nitrates above 6 mg/l NO_3) was eliminated for 1988 because of the unavailability of new data and the long term trending nature of this parameter. This will be reported on every three years only.

Trends, 1987 to 1988:

- The number of ground-water based drinking water systems has increased. During this same period the numbers of systems with MCL violations has decreased and the number of systems not reporting chemical data has also decreased. Despite these encouraging trends in compliance rates, the population at risk from systems in violation of MCLs has increased.

Hazardous Waste Indicator

Characteristics:

- Site ground-water contamination status:
  1) Compilation of data on the numbers of sites at which ground water has been analyzed;
  2) ground-water contamination, but no drinking water contamination, has occurred;
  3) ground-water and drinking water contamination noted;
  4) ground-water contamination, but impacts on drinking water supplies unknown;
  5) no ground-water contamination has been discovered.
- Population at risk from contaminants in drinking water wells.

Changes:

- Site categorization was converted to a relational, mutually exclusive scheme, to avoid the ambiguity and inconsistencies of the 1987 compilation. The distinction between on-site and off-site contamination of ground water and drinking water was eliminated.

Trends:

- Trends will be evident when the 1989 compilation is completed.

Pesticides Indicator

Characteristics:

- Number of leachable, active ingredients in pesticide products currently registered in WA, OR, ID; number of leachable products registered nationally; number registered prior to 1988.

Changes:

- This is a new indicator for pesticides in 1988.

Trends:

- Trends will be evident when the 1989 compilation is completed. In 1988, all EPA registered "leachers" registered for use in crops grown in the Northwest were also registered for use by all of the Region 10 states.

Underground Storage Tank Indicator

Characteristics:

- UST Program: Number and percent of corrosion-protected tanks in use
- LUST Program: Number of leaking tank cleanups initiated and controlled

Changes:

- The LUST indicator for tank cleanups, representing reduced risk of population exposure to contaminated ground water, was added.

Trends:

- The total proportion of protected tanks in Region 10 rose from 13 per cent in 1987 to 18 per cent in 1988. Washington showed an increase, from 15% to 21%; Idaho remained constant at 9% in both 1987 and 1988; Alaska remained constant at 10% each year; while Oregon data for 1988 were not available for comparison to the 15% figure for 1987.
- Trends for the LUST indicator, the number of cleanups initiated and controlled, will become evident when the 1989 compilation is completed.

Chapter 7: Air

Air Environmental Indicators
FY 88

1. **Criteria Pollutants**
   - **Ambient air quality data and analyses**
   - **Emission inventory data (for use as a surrogate measure)**

   (Obtained from reasonable further progress reports for non-attainment areas, and SIP submittals for PM10; future submittals for CO/O3)
2. **Air Toxics**
   - **Begin to track annual changes to baseline air toxics inventory for selected pollutants**
   - **Review state evaluation and control of point sources of toxic air pollutants**
3. **NESHAP (Asbestos)**
   - **Track notifications, inspections and notices of violation**
4. **SIP Activities**
   - **Track rulemaking activities/SIP approvals by pollutant**
5. **Enforcement**
   - **Track significant violators--NSPS, non-attainment areas, federal facilities, and compliance orders**
   - **Explore the possibility of linking specific enforcement actions (i.e., reduced emission rates) to decreases in ambient pollutant concentrations**
6. **Radiation**
   - **Explore the establishment of baseline radon levels based on existing data; compare baseline to future measurements**
   - **Explore the use of ERAMS (Environmental Radiation Ambient Monitoring System)**
   - **Explore the establishment of a pilot study to track the distribution of homeowners' pamphlets and at a later date, survey those households to determine if "measures" were taken**

1. Criteria Pollutants

EPA has established ambient air standards for six pollutants: nitrogen dioxide, sulfur dioxide, lead, carbon monoxide, ozone and particulate matter. The environmental indicator for all these pollutants is the data acquired from the ambient monitoring network throughout the Region. Based upon this data, areas which do not meet the criteria pollutant standards have been designated "nonattainment areas." State Implementation Plans (SIPs) for attaining and maintaining the ambient standards are required for the nonattainment areas.

Environmental Indicator:
Monitoring Data for Criteria Air Pollutants

Data from the monitoring networks reveal which areas exceed healthful levels of the criteria air pollutants. By correlating such characteristics as time of day and weather patterns, EPA can detect conditions which lead to high pollution levels. For example, stagnant air during winter weather inversions often leads to extremely high levels of particulate matter (PM_{10}), as people are more likely to use their woodstoves during colder weather. Peak rush-hour traffic correlates to higher levels of carbon monoxide (CO).

As an environmental indicator, the use of monitoring data is limited, in that the networks are generally set up only in "high risk" areas, places that have a known potential for violating the air quality standard(s). While the data reflect air quality in populated communities, outlying areas that may be affected only periodically by higher pollution levels are neglected. It is presumed that, by monitoring in "high risk" areas, the network records the worst air quality violations, and that all other (nonmonitored) areas are comparably "better." Budget constraints prevent monitoring in every incorporated area.

The present fixed monitoring network is a reasonably adequate reflection of the air quality in the Pacific Northwest for all pollutants except particulate matter. Based upon our experience with short term monitoring studies we believe that a number of unmonitored communities have particulate matter problems. EPA and the states are using less expensive, short term monitoring to systematically investigate these areas. Based on the results, fixed monitors will be located in communities with particulate matter problems as budgets allow.

Environmental Indicator:
Emission Inventories

Emission inventories estimate the amount of a particular pollutant that is emitted into the atmosphere per year. Estimates are received directly from industrial point sources or determined by control agencies, and are approximated for area sources, such as automobiles, or agricultural burning. Annual estimates allow state and local officials to concentrate their pollution control efforts on sources which can most easily be contained. Emission inventories are only partially useful as indicators of environmental health, as they are usually calculated emission rates from similar, representative sources and do not account for atmospheric dispersion.

EPA is not responsible for tabulating this data; emission inventories are required by EPA's State Implementation Plan (SIP) regulations. Updated emission inventories for all sources of carbon monoxide, particulate matter, and ozone will be required as part of EPA's call for new pollution control plans in each of the four states. Annual updates of inventories for industrial point sources are required by SIP regulations. It is anticipated that the updated emission inventories will be available for next year's report.

There will be no new environmental indicators for criteria pollutants in the near future. Surrogate indicators, such as approved SIPs, number of nonattainment areas, etc., may be recorded for next year, but such indicators are policy-based and do not reflect actual air quality.

Nitrogen Dioxide (NO_2)

The NO_2 standard has not been threatened in the region for several years because of the reduction in motor vehicle emissions from the Federal Motor Vehicle Control Program and relatively low industrial emissions. Current monitoring efforts are sustained in order to identify ozone precursors in the Portland, Oregon/Vancouver, Washington, airshed.

NO_2 is not a Regional priority. In fact, Region 10 encourages Headquarters to consider reducing ambient NO_2 monitoring in order to support the other criteria pollutant programs. The only NO_2 nonattainment area in the country is located in the Los Angeles, California basin.

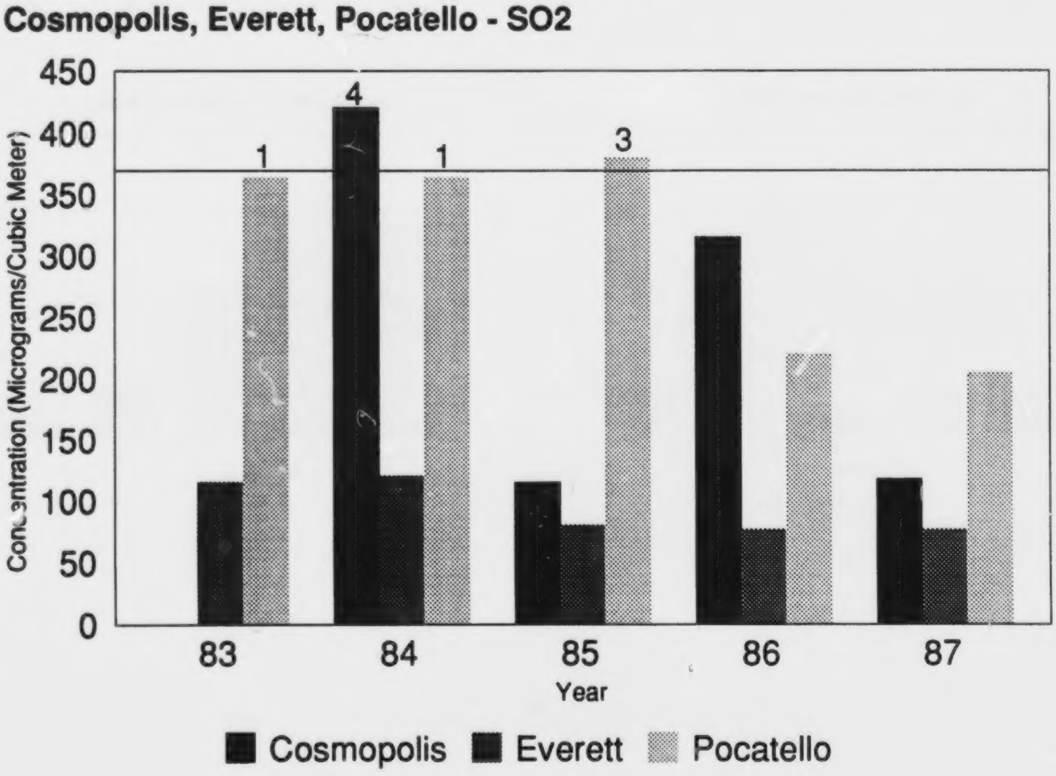
Sulfur Dioxide (SO_2)

Based upon the SO_2 monitoring data and air quality modeling by Region 10's Environmental Services Division, two areas in the Region have been identified that show significant impact on local air quality from specific sources. Emission control equipment will be required for a pulp mill in Cosmopolis, Washington, and for a phosphate fertilizer plant in Pocatello, Idaho, to reduce emissions in order to attain the SO_2 standard of 365 microgram per cubic meter (24-hour average). Control technology is being evaluated for a plant in Conda, Idaho, to eliminate violations which have been monitored in that area. The monitoring data indicate that all other areas are currently meeting the ambient SO_2 standards.

A SO_2 modeling study conducted in Everett, Washington during FY87 evaluated the emissions from the pulp mills located there. A primary objective of the study was to determine whether the pulp mills would cause violations of ambient standards at maximum allowable emission rates. The study shows that the Everett mills are operating at less than maximum capacity, thereby not significantly impacting the air quality in that area. However, the study did indicate the potential to exceed the standards if the mills were operated at full capacity. Since the SIP does not prevent such an increase from occurring in the future, the Regional Office will likely issue a SO_2 SIP call for the Everett area.

Another SO_2 modeling study was conducted at Pacific Power and Light in Centralia, Washington. This study used a simple "screening" model to assess the possibility of violations around the plant. The study showed that there was a high probability of significant violations downwind of the facility. As a result, the company began October 1, 1988 a program of meteorological air quality and emissions monitoring in order to perform a more sophisticated modeling study. The results of this study which should be completed in 1990, will be evaluated by EPA and, depending upon the results, may then be used as a basis for a SIP call in the Centralia area.

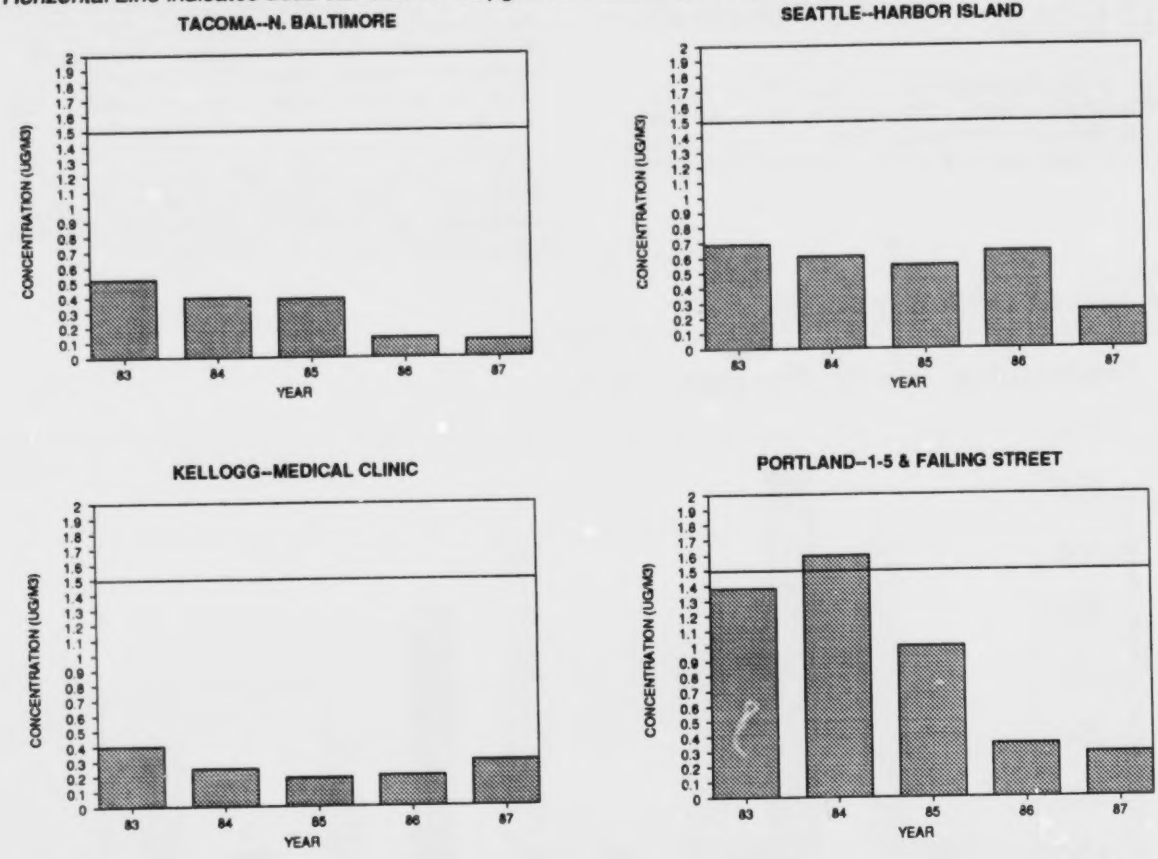
Figure 7.1
Ambient Data for Sulphur Dioxide
Horizontal Line indicates 24-hour average standard of 365 µg/m³.



Lead

The lead standard is expressed in terms of a 1.5 micrograms per cubic meter (µg/m³) quarterly mean. During the last four years, there have been no violations of the lead standard in any major metropolitan area in the Pacific Northwest. For example, in Seattle a 72 percent decrease in ambient concentrations has been demonstrated between 1983 and 1987. In Portland, the ambient levels have decreased 75 percent. The closure of primary nonferrous smelters (Bunker Hill in Silver Valley, Idaho and ASARCO in Tacoma, Washington) and secondary lead smelters (Quemetco in Seattle, Washington and Bergsoe in Portland, Oregon) has helped to lower lead levels in these areas. Another contribution to the lower lead levels has been the reduction of lead in gasoline, thus reducing the contribution of automobile exhaust as a source of lead in the ambient air.

Figure 7.2
Ambient Data for Lead
Horizontal Line indicates Lead standard of 1.5 µg/m³, maximum quarterly average.



Carbon Monoxide (CO)

Compliance with the ambient standard for carbon monoxide is determined using eight-hour and one-hour averages. The second maximum eight-hour concentration during a year is considered the decisive measure of air quality, since the one-hour standard is rarely exeeded. There should be no more than one violation (the excused maximum concentration) per year.

Region 10 currently has 13 areas which do not attain the national CO eight hour standard of 9.0 parts per million (ppm). Violations generally occur during the winter season, when colder temperatures cause an increase in vehicle emissions, and weather inversions cause those emissions to stay concentrated at ground level. For the most part, these areas have improved significantly over the last few years due to the implementation of various traffic and automobile control measures at a local level, as well as the influx of cleaner burning automobiles due to the Federal Motor Vehicle Emission Control Program (FMVECP). Seven of the nonattainment areas in Region 10 have vehicle inspection and maintenance (I/M) programs to control automobile emissions. These control programs have helped the areas to achieve significant reductions in CO concentrations.

Due to annual population growth and varying weather conditions (and shortfalls in some control programs), several areas in Region 10 continue to be out of compliance with the CO standard. In a review of the monitoring data for the last two full years (1986 and 1987), nine nonattainment areas failed to attain the standard by the statutory date set forth by the Clean Air Act of December 31, 1987. As a result, Region 10's Regional Administrator advised the Governors of Alaska, Idaho, Washington and Oregon that their State Implementation Plans for carbon monoxide required a revision to provide for the attainment and maintenance of the CO standard.

A brief description of Region 10's CO nonattainment areas is as follows:

Alaska

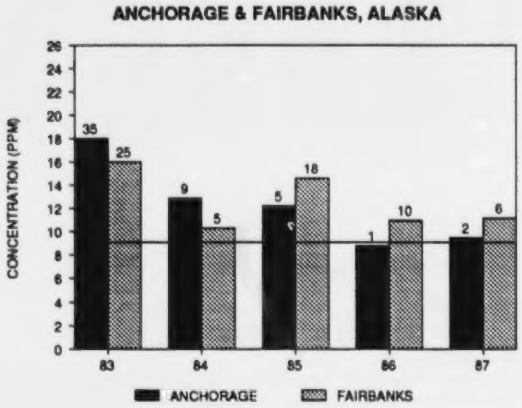
Anchorage, Fairbanks

Because of their extremely cold winter temperatures, Anchorage and Fairbanks both experience high CO concentrations. I/M programs in both cities were initiated in 1985, and are considered by EPA to be the most aggressive in the nation. The positive changes in air quality are obvious, but additional controls are necessary to guarantee that the areas attain and maintain the standard. Both cities have received a SIP call.

Figure 7.3

Ambient Data for CO in Anchorage, Fairbanks, AK

Data Below reflects 2nd maximum, 8-hour averages for each year. Horizontal line indicates standard of 9.0 ppm; number above bars indicates total exceedances of the standard, per year.

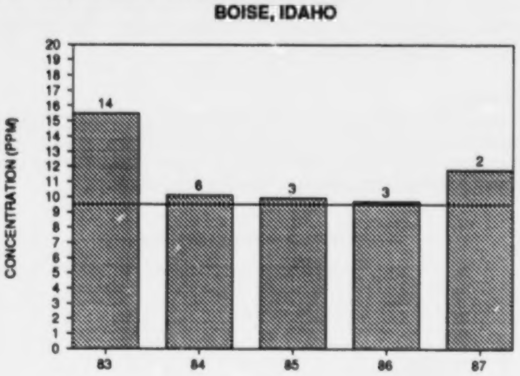


Idaho

Boise

Boise is the only nonattainment area in Idaho and is close to meeting the standard. The I/M program in Boise will continue through March 1990. Boise received a SIP call for an attainment plan to be replaced by a maintenance plan if recent data demonstrates attainment.

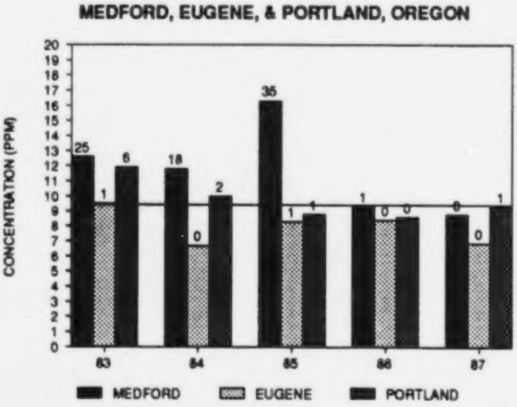
Figure 7.4
Ambient Data for CO in Boise, ID
Data Below reflects 2nd maximum, 8-hour averages for each year. Horizontal line indicates standard of 9.0 ppm; number above bars indicates total exceedances of the standard, per year.



Oregon

Medford, Eugene, Portland

Figure 7.5
Ambient Data for CO in Medford, Eugene, Portland, OR
Data Below reflects 2nd maximum, 8-hour averages for each year. Horizontal line indicates standard of 9.0 ppm; number above bars indicates total exceedances of the standard, per year.



Violations of the CO standard in Medford have decreased from 35 in 1985 to 2 in 1987; yet the highest recorded CO concentration in Medford was sufficient to warrant a SIP call for the area.

Portland has had an I/M program since 1975, and has not recorded a violation of the CO standard since 1985. The I/M program helps to maintain the low CO levels, as well as controlling hydrocarbon emissions which contribute to Portland's high ozone levels (to be discussed in the next section).

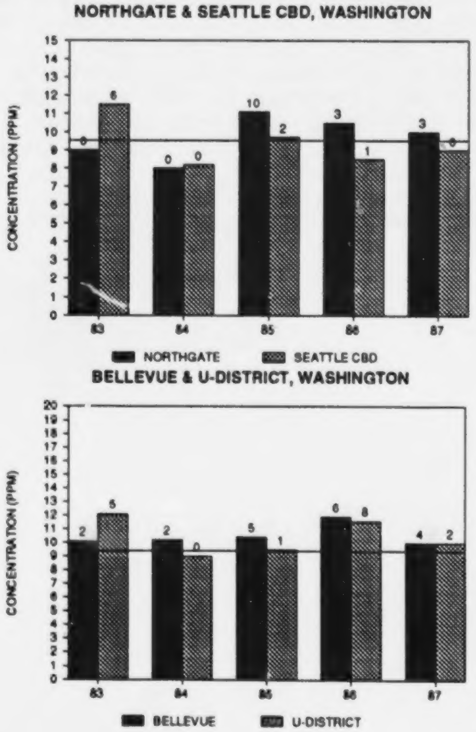
In Eugene, the concentrations have stabilized over the last few years just below the standard, and the State of Oregon and local officials are preparing the documentation to request a redesignation to attainment for the Eugene area.

Washington

Seattle, Spokane, Tacoma, Everett, Vancouver and Yakima

The CO nonattainment area for metropolitan Seattle is made up of four smaller area "hot spots": Bellevue, the University district, the downtown Central Business District, and the Rainier Avenue/Dearborn corridor. A centralized I/M program was begun in 1982. However, due to meteorological conditions, major downtown construction activity and population growth, Seattle has not yet achieved the CO standard. Each area has recorded violations and is included in a Washington SIP call.

Figure 7.6 & 7.7
Ambient Data for CO in Seattle, WA
Data Below reflects 2nd maximum, 8-hour averages for each year. Horizontal line indicates standard of 9.0 ppm; number above bars indicates total exceedances of the standard, per year.

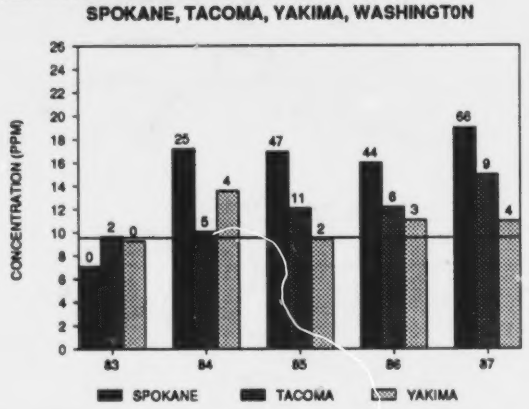


In terms of the magnitude of the CO problem, Spokane's I/M program has produced excellent results for the city's air quality--and yet Spokane recorded 66 violations at one site during 1987. Both Tacoma and Yakima continue to exceed the CO standard. All three of these cities received a SIP call request.

Figure 7.8

Ambient Data for CO in Spokane, Tacoma, and Yakima, WA

Data Below reflects 2nd maximum, 8-hour averages for each year. Horizontal line indicates standard of 9.0 ppm; number above bars indicates total exceedances of the standard, per year.



A new monitor in Everett revealed that the CO standard was exceeded on three occasions during 1987; this is considered by EPA to be sufficient to require that a SIP be developed. Another city that was formerly not considered to be a CO nonattainment area is Vancouver, Washington, a part of the Portland, Oregon airshed. Four violations of the CO standard occurred during 1987. A revised plan to deal with the CO problem is necessary. No graphs of the Everett or the Vancouver data are included in this report, as there is insufficient annual data to establish any trend.

Ozone

Region 10 has only one ozone nonattainment area--the Portland, Oregon/Vancouver, Washington interstate area. Due to exceedances of the standard during the last three years, it was determined that the standard would not be met by the statutory deadline of December 31, 1987.

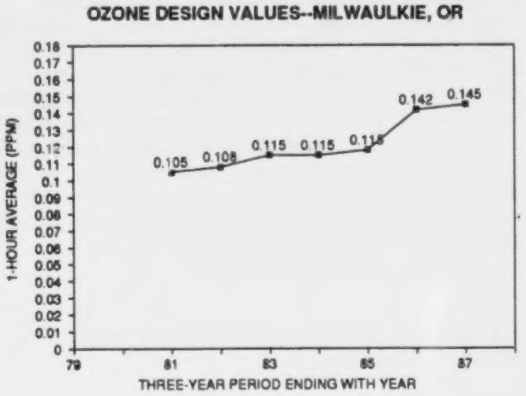
In June, 1988, Region 10's Administrator advised the Governor of Oregon that the Oregon ozone SIP required review and revision as necessary, in order to provide for attainment and maintenance of the ozone standard in the Portland-Vancouver area. A similar letter was sent to the Governor of Washington regarding the Washington SIP.

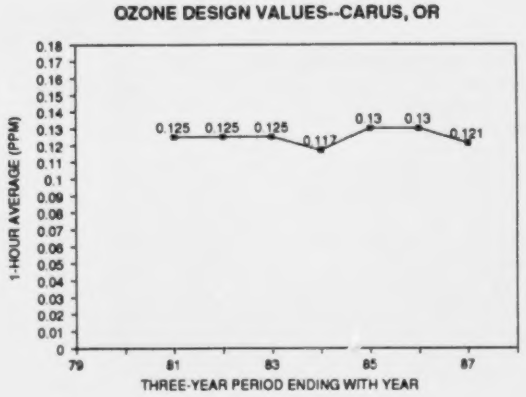
An EPA sponsored special monitoring study was done during the summer of 1987. Ambient ozone monitoring was increased from three sites to six sites and additional ambient VOC and nitrogen oxides sites were established. Initial analysis of the data leads EPA to believe that the existing monitoring network may underestimate the extent of the ozone problem in the Portland, OR/Vancouver, WA airshed. In order to properly evaluate and verify the severity of the ozone problem, this study continued during the summer of 1988 with one additional monitoring site.

Figure 7.9

Ozone Design Values for Two Monitoring Sites for the Portland, OR/Vancouver, WA Airshed

The ozone design value is the fourth-highest recorded value over a three year period; EPA uses the design value to determine the VOC emission reduction that must occur to attain the 0.12 ppm standard.





Particulate Matter (PM_{10})

The PM_{10} monitoring network within Region 10 began in 1985. Data available to date indicate that some Region 10 areas have experienced significant reductions in ambient particulate concentrations, while levels in other areas have remained constant or shown increases in both the level of concentrations and the frequency of violations.

Data from areas such as Juneau, AK and Boise, ID show significant reductions in particulate concentrations over the last two years. These reductions can be attributed to local woodstove curtailment programs, and other state-initiated programs to reduce particulate emissions. Data from other areas such as Klamath Falls and Medford, OR, indicate that air quality is worsening, due in part to increased use of wood for space heating. Residential wood combustion is a primary cause of PM_{10} violations in Region 10, and without rules governing woodstove usage during wintertime weather inversions, air quality in areas such as Klamath Falls and Medford is likely worsen. A further concern is that even with federally enforceable control plans, these areas are not expected to attain the standard.

Table 7.1

Summary of Monitoring Data for All Major PM_{10} Areas in Region 10

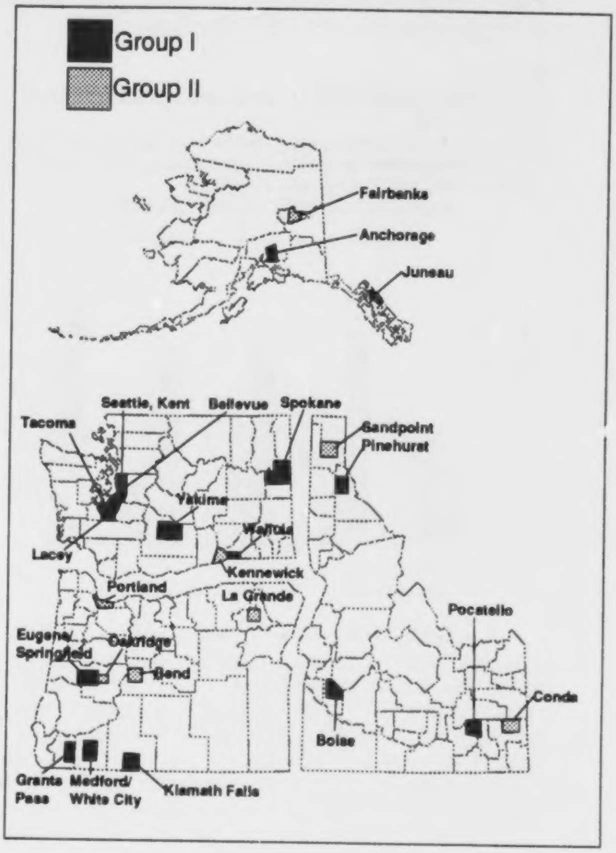
Group I Areas

	Maximum Values (µg/m³)			
	1985	1986	1987	1988*
Anchorage (Eagle River), AK	220	336	147	--
Juneau, AK	--	240	100	--
Pinehurst, ID	--	372	189	--
Boise, ID	--	314	107	--
Pocatello, ID	--	160	120	--
Klamath Falls, OR	--	340	298	792
Medford/White City, OR	370	211	249	219
Grants Pass, OR	200	148	268	132
Eugene/Springfield, OR	267	157	175	146
Seattle/Kent, WA	248	201	164	163
Tacoma, WA	211	175	203	184
Lacey, WA	254	179	130	89
Spokane, WA	370	144	165	170
Yakima, WA	192	154	131	63
Wallula, WA	--	211	232	72

* *1988 data current through March, 1988.*

Figure 7.10

Region 10 Group I and Group II Areas for PM_{10}


■ Group I
▨ Group II
Fairbanks
Anchorage
Juneau
Seattle, Kent
Bellevue
Spokane
Tacoma
Sandpoint
Pinehurst
Yakima
Wallula
Lacey
Kennewick
Portland
La Grande
Pocatello
Eugene/Springfield
Oakridge
Bend
Conda
Boise
Grants Pass
Medford/White City
Klamath Falls

2. Air Toxics

Unlike the criteria air pollutants, ambient monitoring data is not routinely available for toxic air pollutants. This is due to the cost of collecting samples, lack of ambient standards for these pollutants, the large number of substances that could potentially be monitored, the lack of standard monitoring methods, and the lack of analytical standards. For these reasons, the current environmental indicators used for air toxics must be surrogates for actual environmental measurements.

Environmental Indicator:
Air Toxic Inventory

Data on existing sources and actual quantities of toxic emissions have been gathered into emissions inventories by state and local agencies. These data are used to identify existing facilities that may be a "high risk" source of air toxics emissions. In addition, the new SARA Title III Section 313 Toxic Release Inventory (TRI) reporting requirement may increase our knowledge of air toxics emissions. The TRI information is not being presented in this year's report for a variety of reasons. First, while the data has been gathered, it has not yet been completely evaluated by the state agencies. Second, it is not in a useful format for this type of report, as the computerized database has not been developed to hold all the information. The database is not scheduled to be available until late spring, 1989. The paperwork that is available is cumbersome, at best. Third, the inventory data is not being established as "stand alone" data--it is to be used as supplementary information only, and is not meant to be a complete listing of all emissions from all industries. Next year's report will hopefully contain some of this data in a useful format--Air Programs staff will explore more reflective indicators for the Air Toxics program for next year.

Environmental Indicator:
Control of Point Sources

It is often possible to control non-criteria pollutants with technology normally designed to reduce criteria air pollutant emissions. The state and local agencies in the region routinely review permit applications from potential sources that fall under the New Source Review (NSR) and Prevention of Significant Deterioration (PSD) programs for air toxics and, to the extent allowed by state regulations and current technology, attempt to control air toxic pollutants. For example, the State of Washington is working to develop new NSR regulations that will further assure that air toxics are specifically controlled during the permit process (i.e., prior to facility operation). The following is a table that summarizes this permit activity:

Table 7.2
FY 88 State Permit Activity

	Alaska	Idaho	Oregon	Washington
Permits evaluated for toxics	9	1	16	26
Permits that result in decreased air toxics emissions	5	1	13	21

The States of Oregon and Washington continue to be the most active in the control of point sources, as would be expected based on the larger number of industrial sources in these states. Oregon shows a 50 percent increase in the number of sources evaluated this year and Alaska has increased the number of evaluations by more than 400 percent. All four states are also showing a significant increase in the number of permits for which specific controls of air toxics was achieved.

While the state and local agencies continue to improve their ability to control air toxics through existing permit procedures, it is apparent that not all air toxics problems can be addressed through permits alone. Area sources, high risk urban problems, and existing point sources must also be addressed.

Studies are underway in Boise, or have been completed in the Puget Sound area, that investigate such urban problems--particularly from woodsmoke. Besides the particulate, or PM_{10} component, woodsmoke contains various chemicals which are regarded as both mutagenic and carcinogenic. Washington and Oregon have both implemented woodstove certification programs designed to control emissions from new woodstoves. Juneau and Boise also have woodsmoke curtailment programs which are in effect during wintertime weather inversions, and several other Alaskan cities are considering similar ordinances. The national standards for new woodstoves became effective on July 1, 1988.

The complexity and magnitude of the air toxics problem makes it imperative that resources are used efficiently. The state and local agencies have used their emission inventories to identify and prioritize facilities with potentially high risks. The Puget Sound Air Pollution Control Agency and the Oregon Department of Environmental Quality have independently developed ranking systems to help prioritize air toxics problems. Although the two agencies have taken different approaches, it is interesting to note that both ranking systems generate remarkably similar results. Table 7.3 is a summary of the high risk point source activities that have resulted from analyzing and prioritizing emission inventory data.

Although none of these projects have been completed to date, the number and quality of planned activities represent significant progress in the air toxics program. We will soon reap the benefits of the previous years of planning and development in the state and local agencies.

Table 7.3

High Risk Point Source Initiatives

Alaska

- Developing an emission standard for ammonia to address excessive emissions from a fertilizer manufacturing facility
- Developing criteria for approval of new hospital incinerators and a strategy for addressing existing hospital incinerators that have been identified as potentially problematic
- Working with local governments to address the unique control problems associated with the use of very small municipal incinerators typical of Alaska

Idaho

- Conducting an EPA-funded study of aldehyde emissions from a sugar beet facility
- Will be evaluating emissions of heavy metals from several phosphate ore operations in southeast Idaho using data from PM_{10} monitors

Oregon

- Conducting an EPA-funded study of chromium emissions from electroplating operations

Washington

- Conducting an EPA-funded study of styrene emissions from two fiberglass boat building operations
- Working with regional EPA and Office of Research and Development to obtain data on air emissions from a municipal incinerator in Bellingham. Washington Department of Social and Health Services will use the data to develop a risk assessment of this facility in response to citizen concerns.
- Will be monitoring PAH emissions from an aluminum smelter
- Will be conducting monitoring at a carbon regeneration facility to determine if operations and controls are effective. This facility is used by Superfund, as well as by many small industries such as dry cleaners.
- Will work with EPA to assess ambient concentrations of VOC emissions from a refinery complex

Regionwide

- In addition to these state activities, Dr. Sharma, a visiting scholar from the World Health Organization, has been working with the state agencies, the University of Washington, and EPA to assess chloroform emissions from pulp mills. His study will be useful to all four states in prioritizing and controlling emissions from this important Northwest industry.

3. Asbestos

Between 1985 and 1988, the Region 10 Asbestos demolition/renovation enforcement program has evolved in both the Air Operations Section and the Office of Regional Council. This evolution has brought with it program expansion, corresponding increases in enforcement cases, and a greater understanding of the federal regulations.

Environmental Indicator: Quality Inspections

Asbestos exposure is controlled through the National Emission Standards for Hazardous Air Pollutants (NESHAPs) program. During FY88, regional efforts in the asbestos program concentrated upon increasing the quality of both abatement project inspections, and inspector training programs. Efficient enforcement of the asbestos NESHAPS regulations is guaranteed only by the availability of qualified inspectors. In FY87, only three EPA inspectors in the region were fully trained; during FY88, eleven additional EPA employees completed the inspector training course. This indicator does not specifically address actual ambient asbestos concentrations, nor does it quantify actual amounts of asbestos removed or contained. However, it is a way in which to measure the efficiency of the program.

The availability of regional inspectors is crucial to the NESHAP asbestos programs in Alaska and Idaho, because during FY88, EPA established fully operational programs in both states. Alaska Department of Environmental Conservation has partial delegation for the enforcement of its asbestos regulations for disposal, and during FY88 Washington and Oregon upgraded their own state regulations, adding extra incentive for contractors and homeowners to comply with the NESHAP rules. Inspectors trained to enforce the NESHAP rules are essential to each of the state programs.

Although the Air Programs Branch deals primarily with the NESHAP rules for ambient asbestos exposure, the NESHAP inspectors cooperate a great deal with the Toxic Substances Control Act (TSCA) program and Occupational Safety and Health Administration (OSHA) in the areas of the Asbestos in Schools and the Worker Protection programs. The EPA NESHAP inspectors have shown the capability to see violations of these other asbestos rules; this ability has yielded six Asbestos in Schools referrals and two Worker Protection referrals to their sister enforcement programs during FY88. These numbers illustrate the strengths of the inspector training program in the region. The NESHAP program experts have also supported the Superfund efforts on industrial sites where asbestos problems need remedial actions.

Environmental Indicator: Notifications, Inspections and Enforcement Actions

The numbers reflected in the following graphs indicate the basic elements of the asbestos program. Ideally, the number of notifications of asbestos projects and inspections of those projects should increase each year, ultimately reaching a "plateau" as more and more asbestos is removed or encapsulated. Concurrently, the number of violations of the NESHAPs rules should decrease, as more property owners and contractors take measures to reduce the risk of asbestos exposure. As can be seen by the graphs, the program is progressing toward these goals.

Figure 7.11
Region 10 Asbestos (NESHAPS) Activity
Notifications of Removal

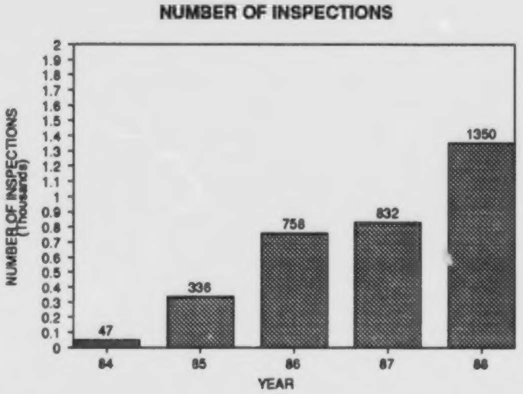


Figure 7.12
Region 10 Asbestos (NESHAPS) Activity
Number of Inspections

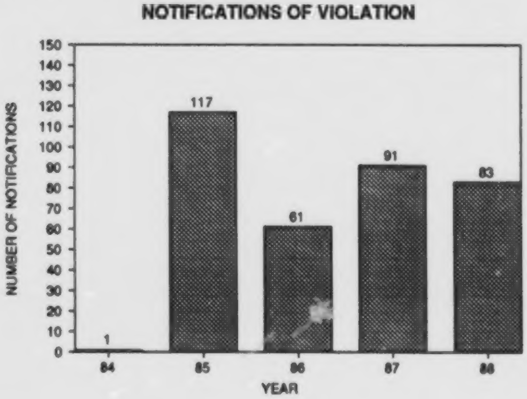
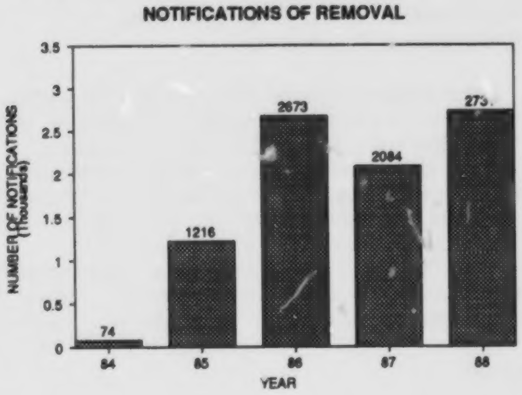


Figure 7.13
Region 10 Asbestos (NESHAPS) Activity
Notifications of Violation



Environmental Indicator:
Public Outreach

One surrogate measure of the asbestos program is the success or failure of the ongoing public education program. Public outreach and education works to prevent violations of the NESHAPs regulations by communicating necessary health and safety information to those individuals involved in asbestos clean-up operations. Response to phone calls, public speaking engagements, newspaper articles, information spots on radio, forums between state and local agencies and other such activities actively disseminate asbestos information to contractors and property owners. The public's risk of asbestos exposure is greatly reduced by this type of federal/state/local agency cooperative communication strategy. Region 10 routinely participates in all these kinds of activities, although there is currently no established quantification.

4. State Implementation Plans

Environmental Indicator:

Tracking Rulemaking Activities

Since the 1970 Clean Air Act established the air quality management process, the regional offices have maintained procedures to monitor the accompanying rulemaking activities. A key objective of the tracking systems has always been to assure the quickest possible timeline for federal approval or disapproval of a state-adopted regulation.

In 1987, the EPA Deputy Administrator established a task group of EPA managers to examine problems in the way State Implementation Plan (SIP) submittals are reviewed and processed in EPA. The length of time needed to process each rulemaking activity was a specific concern. On a national average, air quality plans and regulation approvals required 14 months to process. This task group examined the entire SIP submittal process, identified underlying problems, and achieved consensus on recommendations for improvement. These recommendations were approved, and the various Headquarters offices are currently establishing specific guidance to implement these recommendations.

Two specific reforms that will help to accelerate the approval/disapproval process involve new guidelines for completeness review and the updated methods of processing various Federal Register documents. The reviewing guidelines will be used during the initial review of each proposed revision. If the state-adopted regulation meets the completeness criteria, that state will be notified within 45 days that an EPA approval or disapproval activity is being prepared. If the revision does not meet the criteria, it is returned to the state. The regional offices will continue to work with the states to insure complete revisions, and will use these new guidelines to eliminate the lengthy historical background write-ups of current SIP revisions.

Additionally, there will be new methods of processing each revision. The length of time to process minor or administrative actions will be shortened to 5 months. With the decentralization of some general program area reviews by Headquarters to the regions, the regional offices will be able to process final rulemakings within 5 months of receipt. These are just two of the new improvements which were approved.

In FY88, only 11 Federal Register rulemaking actions were published compared to Region 10's historical record of more than 25. With the new streamlined procedures, the processing of Registers will increase to former levels as a result of the post '87 SIP calls for carbon monoxide and ozone, the PM_{10} SIPs, and the processing of current regional backlog.

5. Enforcement

A key element of the air enforcement program is the process of assuring all major stationary sources of regulated air pollutants attain and maintain continuous compliance with the State Implementation Plan(s) and the Clean Air Act. The air enforcement and compliance responsibilities include administrative and informational duties, as well as providing for the legal and technical needs of the state enforcement programs.

Environmental Indicator:
Enforcement Activities

One objective of the air enforcement program is addressing the challenge of returning those sources which violate the standards to compliance with state and federal emission limitations. All four Region 10 states commit to inspect a particular number of sources each year, thus maintaining accurate records of the compliance status of the industries within their states. The Compliance Data System (CDS) is the computerized source tracking network which is used by the state agencies and EPA to mutually keep tabs on enforcement program activities. The EPA Regional office monitors the progress towards meeting these commitments, and periodically defers to the Operation Offices for verification.

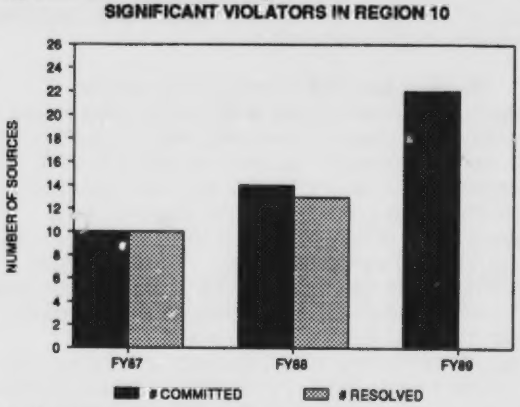
The Significant Violator program is intended to identify the high priority sources within the region, so that the annual goals of the state and EPA enforcement programs are coordinated. A fixed base of significant violators is identified for resolution each fiscal year. EPA has the authority to begin enforcement activities towards a particular source if it determines that a state is not making timely and appropriate progress regarding enforcement of the regulations.

Tracking the significant violators is indicative of the level of detail that the Region 10 enforcement staff devotes to the individual sources within the region. But with the multitudes of industrial sources within the four states, it is impossible to maintain detailed records on every source--there is simply not enough staff, time or monetary resources to deal with all the sources.

During FY88, there were fourteen significant violators identified as the fixed, beginning-of-the-year (BOY) base. Of those fourteen, 13 were resolved by the end of September, 1988. The remaining violator is the U.S. Air Force Base on Shemya Island (Aleutians) in Alaska. The Base's permit for its two diesel-powered waste incinerators expired in January 1985, and the source has not yet fulfilled all requirements to renew its permit. EPA issued a Notice of Violation in September 1988, but deferred to the state as it negotiated a consent decree with the Air Force. The order, signed in March 1989, calls for replacement of the incinerators with one of smaller capacity that will not be subject to state regulations, except opacity.

The following graph summarizes the quarter by quarter activities with the significant violators in the four states.

Figure 7.14
Significant Violators in Region 10



Environmental Indicator:
Decrease in Pollutant Emissions as a Result of Specific Enforcement Activities

This indicator illustrates emission reductions at a point source, where enforcement actions have caused the source to reduce emissions. Although it does not always directly correlate to ambient pollutant levels, this indicator does show how effective enforcement activities can be to ensure that an industrial source remains within the legal allowances for air pollutant emissions. For example, indications of reduced emissions due to EPA's enforcement involvement has been noted at Pacific Power and Light in Centralia. EPA's calculations based on sulphur content in coal burned showed SO_2 emission limits were being exceeded at least 17% of the time during a three month period in 1985, based upon a 24-hour average. (If the emissions had been monitored for compliance with the State of Washington's one-hour SO_2 standard, the percentage would have been higher.) Both EPA and the local agency required Puget Power to install continuous emission monitors (CEMs) and to submit Excess Emissions Reports (EERs). The first three month report showed an exceedance rate of less than 1.6%, down from more than 17%. Thus, the time that the plant is operating in exceedance of the SO_2 SIP limit has been reduced by 90%.

In another example, Kaiser Aluminum and Chemical Inc. in Trentwood, WA has been cited by the local air pollution agency for 13 exceedances of the opacity standard in a three month period in 1986. After continued pressure from EPA including a referral to Justice, Kaiser has reduced the frequency of its violations to as few as two in the last quarter of 1988.

6. Radon

Radon is a radioactive gas which is a product of the natural decay of uranium. In the outdoor air, radon is diluted to such low concentrations that it is nothing to be concerned about. However, once inside an enclosed space (such as a home) radon can accumulate to harmful levels. Long term exposure to high levels of radon gas has been linked to the increased incidence of lung cancer in uranium miners. In Region 10, as well as throughout the nation, EPA's effort to reduce the public health risks due to radon exposure has been concentrated in three areas:

- ***research concerning radon levels;***
- ***research of radon mitigation methods; and***
- ***public education.***

Environmental Indicator:
Measured Radon Levels

Monitored levels of radon in homes gives an indication of actual population exposure to the radioactive gas. This environmental indicator is limited in that radon levels in an individual house can vary drastically from day to day based upon such diverse factors as seasonal weather patterns, use of heating and ventilation systems in the home, housing type, soil type, etc. EPA has established a level of 4 picoCuries (pCi/l) per liter, annual average, as the advised action level for radon; levels above 4.0 pCi/l warrant some type of remedial action. The health risks (i.e., the increased chance of developing lung cancer) associated with radon exposure are based on annual average exposure; only data from year-long monitors can accurately reflect the homeowner's actual risk. The information listed in Table 7.4 is based upon three-month long measurements, unless otherwise indicated. It is therefore potentially biased in that it produces only a "snap-shot" of annual average concentrations.

There are two basic measurement methods which are readily available to the homeowner: the alpha track monitor, which is exposed for 3-months to a year; and the charcoal canister, which is exposed from 3 to 7 days. Ideally, for risk estimation, all the data would be from year-long detectors. However, since the short term charcoal canister is a less expensive option with quicker results, many people choose it to discover their home's potential for radon accumulation. Yet another limitation of the available data is the fact that there undoubtedly is more data, but homeowners are not required to report their radon levels to any agency. Often homeowners prefer that no one know the levels found, as the presence of excessive radon is viewed as detrimental to the value of the home.

Table 7.4
Radon in the Pacific Northwest

State	Number of Sites	Method*	Highest Reading	Percent Over 4 pCi/l
Oregon	9,559	AT	67.25	3.9%
Washington	19,018	AT	102.90	3.3%
Idaho	1,038	AT	63.30	27.6%
	1,018	CC	134.9	31.9%
Alaska	569	AT	249.30	14.8%

* AT = *Alpha track monitor; must be exposed for a minimum of three months; data compiled from Bonneville Power Administration* ***Radon Monitoring Report No. 9,*** *July, 1988 and the Alaska Department of Health and Social Services.*
CC = *Charcoal canister monitor; exposure period of 3-7 days; data compiled from* ***Screening Survey of Idaho Homes,*** *February, 1988.*

The highest radon levels in Region 10 are routinely found just outside Fairbanks; in the northeastern corner of Washington; throughout the northern and central parts of Idaho; and along the Columbia River Gorge at the Oregon/Washington border.

In spite of the limitations in the available data, there exists the opportunity to enhance the Region 10 radon database by requesting that the companies that provide the radon detectors throughout the region send copies of their data, by zip code, to the regional office. This data, when supplemented with state geological data, will provide the opportunity to find specific "hot spot" areas within the Region.

Environmental Indicator:

Radon Questionnaire

One radon indicator which was proposed in the FY87 Environmental Indicator Report was the establishment of a radon questionnaire. This questionnaire would follow-up with those citizens who requested information from EPA's regional office, to discover what action, if any, those people took after receiving the information pamphlets on radon and radon mitigation techniques. The project was not carried out in full during this year; the data available is limited to tracking the number of people phoned from each state. During FY88, 210 requests for information were received from within Washington; 26 from Oregon; 25 from Idaho; and 12 from Alaska, reflecting a total of over 5,000 pieces of information mailed from the regional office. (These numbers also reflect state and local agency requests for mass quantities of information for their own distribution purposes.) The distribution numbers above are somewhat misleading, in that they only indicate those people who have actually telephoned the regional office. They are not indicative of the number of persons who hear of radon through the television, radio, or newspaper, and contact local or state environmental health agencies instead.

Surrogate measures will serve to indicate the level of regional involvement in educating the public about radon. Two staff members currently devote most of their time to the radon program, in the capacity of answering information requests and telephone inquiries. One staff member's primary responsibility is outreach to groups interested in learning about radon. In September, 1988 Region 10 sponsored the EPA course **Reducing Radon In Structures**, a three-day course teaching mitigation of high radon levels to government personnel, general contractors and interested public. Another such course will be offered again in March, 1989.

Congressional passage of the Indoor Radon Abatement Act in October, 1988 has given EPA the mandate to continue its efforts in researching radon and radon reduction techniques, and to continue its effort in public education. Among the many activities scheduled to be carried out at a national level, EPA plans to establish Regional Radon Training Centers to offer radon instructional courses on a regular basis. Three such centers are scheduled to be operating by October, 1989. Region 10 is currently working with various universities within the region in hopes of locating one of the centers here in the West. Region 10 will continue its commitment to inform the public about the dangers of radon.

Environmental Indicator:

Use of Data from the Environmental Radioactivity Ambient Monitoring System (ERAMS)

A commitment was made in the FY87 Environmental Indicator Annual Report to investigate the usefulness of using the ERAMS data as a gauge of environmental risk from radionuclides. Over the year it was decided that the data available is not useful for this type of report. The data rarely reflects anything other than natural background radiation. In emergency situations, such as the Chernobyl incident, the network was useful for tracking the path of the residual cloud of radioactive particulate. The ERAMS system operates best and shows the most results under emergency circumstances, but does not directly indicate environmental health. It will therefore not be used as an environmental indicator in this or future reports.

Air Environmental Indicators
Modifications for FY 89 and Beyond

1. Criteria Air Pollutants

- Ambient air quality data and analyses -- Graphs are used to illustrate the ambient data trends for the criteria air pollutants. The graphs will be modified to indicate when significant events occured which affect the trend (i.e., smelter closures, start-up of I/M programs, etc.).
- Emission inventory data will be graphed, as available, and plotted against ambient levels to detect area-wide trends. Data availability will be the determining factor as to whether this indicator is fully developed.

2. Air Toxics

- Summarize local risk assessments done to date, showing any "success stories"--specifically high risk point source activities
- Summarize the progress towards the development of air toxic regulations at the state level

3. Asbestos

- Continue displaying notices of violation, notifications, and inspections--attempt to show graphically how the increased inspections and notifications result in fewer violations.
- Drop public outreach and quality inspections as specific indicators.

4. State Implementation Plan Tracking

- Eliminate as environmental indicator--incorporate discussion of SIP process into criteria air pollutant section

5. Enforcement

- Continue summarizing significant violator activity.
- Expand the specific activities indicator to include more "case studies" of actual enforcement activities which result in emission reductions, if they are available.

6. Radon

- Track information and technical assistance provided to the public. Given that this program is by nature a public outreach effort, document the ways in which radon is communicated to Region 10 areas.
- Estimate percentages of population in "high risk areas" who have monitored/mitigated their homes, based upon available data.
- Discontinue use of Environmental Radiation Ambient Monitoring System (ERAMS) data as an environmental indicator.

7. Photo History

- Attempt to enlarge the Air Program photo library to document success stories (i.e., before and after pictures). This element is contingent upon travel budget and availability of photographic equipment.

Chapter 8: Toxics - PCBs

Toxics Environmental Indicators for PCBs FY 88

1. **PCBs in Sediments, and Fish and Shellfish**
2. **PCB Compliance**
3. **PCB Early Disposal**

1. PCBs in Sediments, and Fish and Shellfish Tissue

Background

The characteristics of polychlorinated biphenyls (PCBs) and their history of use in the United States create obstacles for determining ambient concentrations of PCBs in the environment. PCBs are extremely resistant to degradation and have been widely used in a number of industrial applications, especially in the generation and distribution of electricity. The period of their use, and hence their deliberate and accidental release into the environment, extends for decades. PCBs are not very volatile and are also insoluble in water, so air and water sampling may not reliably show the presence of PCBs, even near a spill area. In the absence of other contaminants, such as solvents, PCBs do not readily migrate through soil matrices, so soil samples are good indicators of released PCBs. However, because PCBs do not substantially degrade over time, a soil sample provides little information concerning when the release occurred.

A better location to examine environmental loading of PCBs is the aquatic environment. Sediment deposition beneath the water column is a much more dynamic process than geological forces acting on land, and some time correlation may be made with the depth of sediment samples, because older sediments are successively buried by newer sediments. Living organisms are even more efficient indicators of PCBs released into the aquatic environment because PCBs, along with other persistent organochlorines, are bioaccumulated. There is some evidence of long-distance transport of PCBs via airborne dust particles, but the amounts of PCBs that may be transported in this manner are probably orders of magnitude lower than the amounts that water bodies receive from sediment deposition.

Most of the available data for PCBs in the aquatic environment in Region 10 are from marine samples. Direct correlations can be made between populated, industrialized areas and high concentrations of PCBs in nearby marine waters. As noted in the 1987 Environmental Indicators report on PCBs, the highest sediment levels of PCBs in Puget Sound are to be found in urban embayments, with much lower levels found in the more remote reference areas of Puget Sound. This suggests that airborne deposition of PCBs is not currently a significant factor in input of PCBs to Puget Sound. We believe the use of marine water PCB indicators in Region 10 is warranted, because it is possible to draw some general conclusions from such data, and also because these areas are the most heavily populated and industrialized in the region.

Description

This report presents data extracted from NOAA's National Status and Trends (NS&T) Program, which covers the Pacific (as well as the Atlantic and Gulf of Mexico). Stations were selected from locations that are thought to reflect the overall area, not from sites that were already known or suspected to be heavily contaminated. The NS&T Program includes two major projects: the Benthic Surveillance Project (50 sampling sites) and the Mussel Watch Project (150 sampling sites). Both are designed to progressively add to a database of historical data also compiled by the NS&T Program. Benthic Surveillance Project 1984 information is here represented by PCB concentrations in sediments and fish livers for sampling sites located in Region 10. The Mussel Watch 1988 data shown are PCB concentrations in bivalves from Region 10 sites.

Results

PCBs in Sediments. Figure 8.1 shows site locations and bar graphs for PCB sediment concentrations at seven sites: Lutak Inlet and Nahku Bay, Alaska; Coos Bay, Oregon; Columbia River Mouth; Nisqually Reach, Browns Point off Commencement Bay; and off Elliott Bay, Washington. Although these data and the PCB data presented in the 1987 Environmental Indicators report were collected in the same approximate time period, the

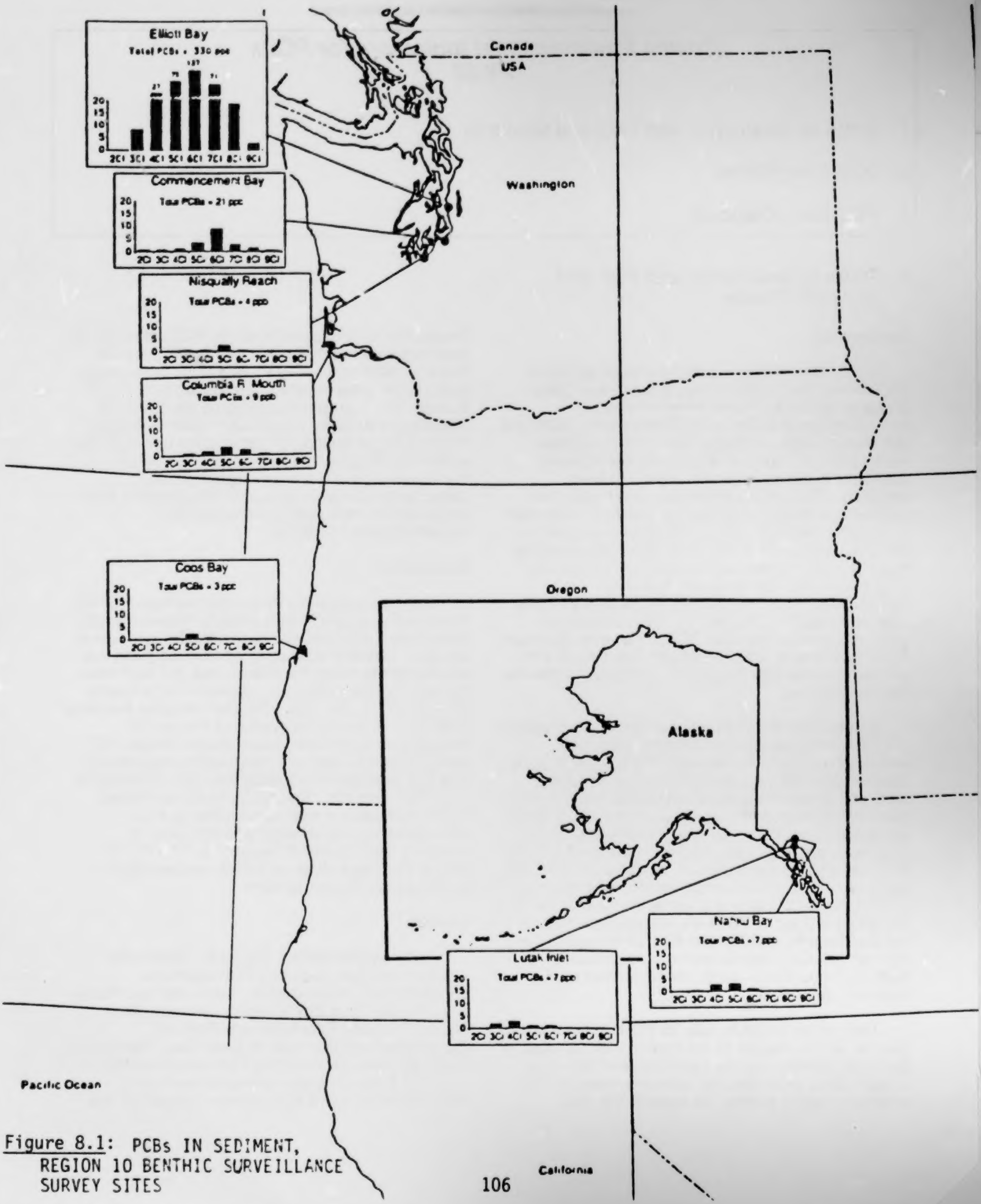

Elliott Bay
Total PCBs = 330 ppb
21
75
107
91
20
15
10
5
0
2Cl 3Cl 4Cl 5Cl 6Cl 7Cl 8Cl 9Cl
Commencement Bay
Total PCBs = 21 ppb
Nisqually Reach
Total PCBs = 4 ppb
Columbia R. Mouth
Total PCBs = 9 ppb
Coos Bay
Total PCBs = 3 ppb
Canada
USA
Washington
Oregon
Alaska
Lutak Inlet
Total PCBs = 7 ppb
Nahku Bay
Total PCBs = 7 ppb
Pacific Ocean
California

Figure 8.1: PCBs IN SEDIMENT, REGION 10 BENTHIC SURVEILLANCE SURVEY SITES

data presented in the 1987 report probably better characterize Elliott Bay and Commencement Bay because more samples from these sites were represented, and the 1987 report includes sampling sites from inside the bays. In addition, the data here presented include information on PCB concentrations in Alaska and Oregon, locations which were not included in the 1987 report. The low concentrations at the Alaska sites and Coos Bay (7 ppb, 7 ppb, and 3 ppb) are consistent with the Nisqually Reach site (4 ppb) and probably reflect the less developed and populated nature of these sites. The relatively low Columbia River Mouth figure (9 ppb) is somewhat surprising, considering that the Columbia River watershed includes the dense population center of Vancouver-Portland upstream and numerous hydroelectric dams further upriver.

PCBs in Fish Liver Tissue. Liver tissue from fish taken at the Benthic Surveillance Survey sites was also analyzed for PCB content. The results for the samples collected at Region 10 sites are:

Lutak Inlet, Alaska	**644 ppb**
Nahku Bay, Alaska	**602 ppb**
Coos Bay, Oregon	**555 ppb**
Columbia River Mouth	**734 ppb**
Commencement Bay, Washington	**4,313 ppb**
Elliott Bay, Washington	**9,397 ppb**

Figure 8.2 provides a comparison of the fish liver tissue results for all Benthic Surveillance Survey sites for which PCB concentrations were detected. The bar graphs show values in descending order. Of concern for Region 10 is the fact that Elliott Bay fish livers exhibited the third highest values of all the samples analyzed by the survey for that year, and Commencement Bay ranked ninth. The ability of fish to bioaccumulate contaminants is of concern because of the potential human health risk associated with consumption of contaminated seafood. Even the Region 10 sites that appeared relatively clean according to sediment PCB values show fish liver tissue values of hundreds of parts per billion.

PCBs in Bivalves. Shellfish are especially suitable organisms to serve as indicators for PCBs at a given site. Unlike mobile fishes, bivalves collected for Mussel Watch are sedentary, spending all of their adult lives in one location. Bivalve molluscs are also filter feeders, straining large volumes of water for edible particles. Because PCBs are more likely to adhere to solid sedimentary particles than to dissolve in water, the mussels taken by the NS&T Program at Region 10 sites are efficient collectors of PCBs that may be distributed in the water column.

Figure 8.3, 8.4, and 8.5 are maps showing the location of NS&T sampling sites in Region 10. The Benthic Surveillance Survey sites previously discussed have three-letter codes; Mussel Watch stations are identified by four-letter codes.

The results for bivalve tissue samples from Region 10 sites are:

Unakwit Inlet, Alaska	**54 ppb**
Port Valdez, Alaska	**83 ppb**
Point St George, Oregon	**131 ppb**
Coos Bay, Oregon (CBCH)	**149 ppb**
Coos Bay, Oregon (CBRP)	**276 ppb**
Yaquina Bay, Oregon	**91 ppb**
Yaquina Head, Oregon	**67 ppb**
Tillamook Bay, Oregon	**112 ppb**
Columbia River, Oregon	**85 ppb**
Grays Harbor, Washington	**90 ppb**
Str of Juan de Fuca, Washington	**59 ppb**
South Puget Sound, Washington	**131 ppb**
Commencement Bay, Washington	**193 ppb**
Elliott Bay, Washington	**1,073 ppb**
Sinclair Inlet, Washington	**322 ppb**
Whidbey Island, Washington	**148 ppb**
Bellingham Bay, Washington	**112 ppb**
Point Roberts, Washington	**113 ppb**

Figure 8.6 is a bar graph representation of Mussel Watch results from the highest PCB concentrations detected in all of the 1986 samples. Of the Region 10 sites, only Elliott Bay is included in the top twenty-five (ranked thirteenth).

Future Directions

The objectives of the NS&T Program are to define the distribution of contaminants in biological tissues and in sediments, to determine temporal changes in contaminant concentrations, and to document biological response to contamination. PCB data extracted from this on-going program for marine water sites in Region 10 will continue to provide information on PCB concentrations in sediments and in fish and shellfish tissue. The program's intention to provide data useful for documenting trends will be accomplished over some period of years.

Another source of information concerning PCB levels in Region 10 will be the Puget Sound Ambient Monitoring Program. Although government agencies and research institutions have long conducted studies in Puget Sound, much of the information gathered could not be easily compared due to differences in sampling and analysis protocols, and many sampling locations were never visited more than once. Such historical studies can provide snapshot examinations of conditions at the time of the study, but are not very useful for long-term trend analysis. Recognizing the shortcomings of existing programs, the 1987 Puget Sound Water Quality Management Plan mandated that a comprehensive long-term environmental monitoring program be developed for Puget Sound.

The Puget Sound Water Quality Authority appointed an interdisciplinary Monitoring Management Committee to design the Puget Sound Ambient

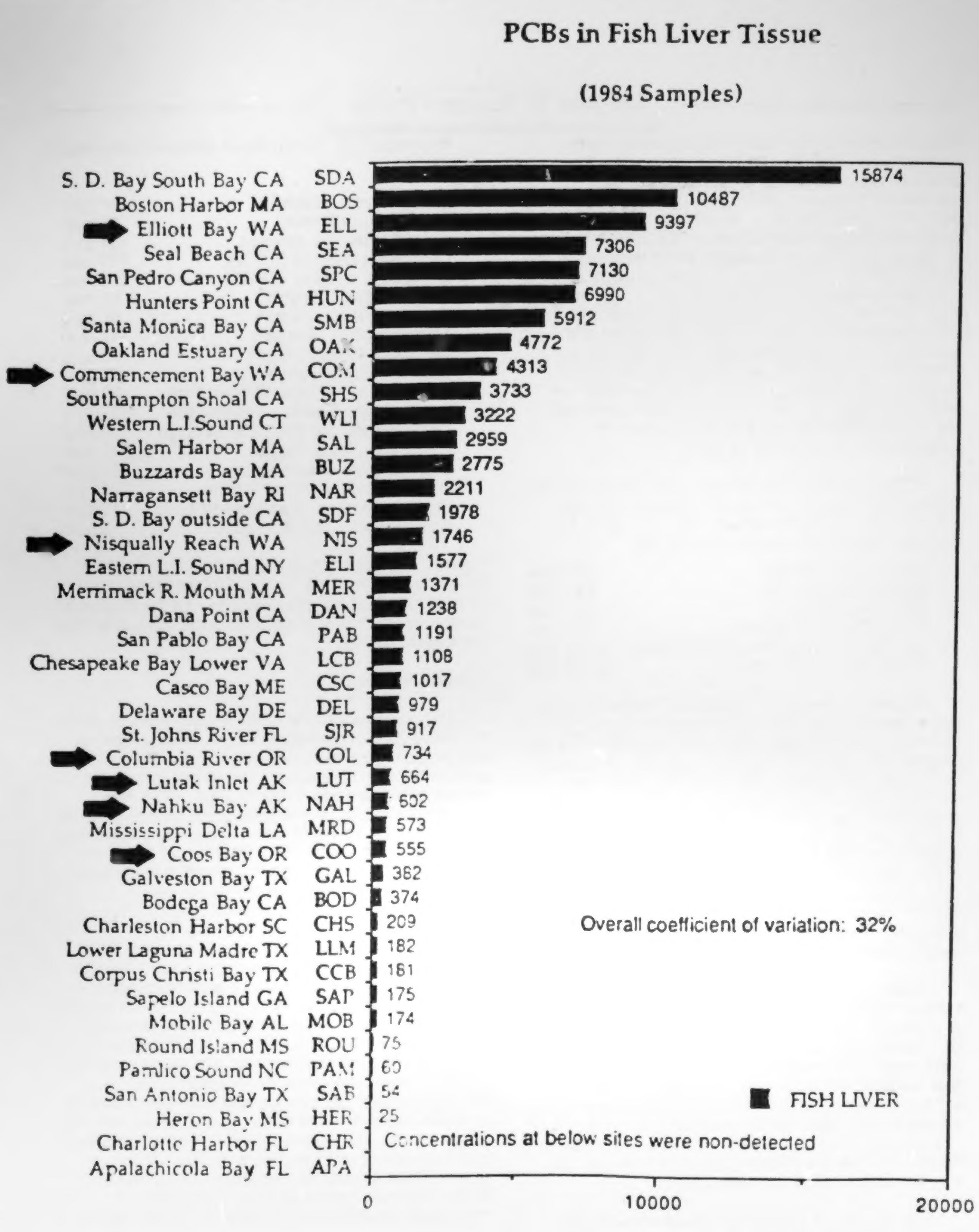
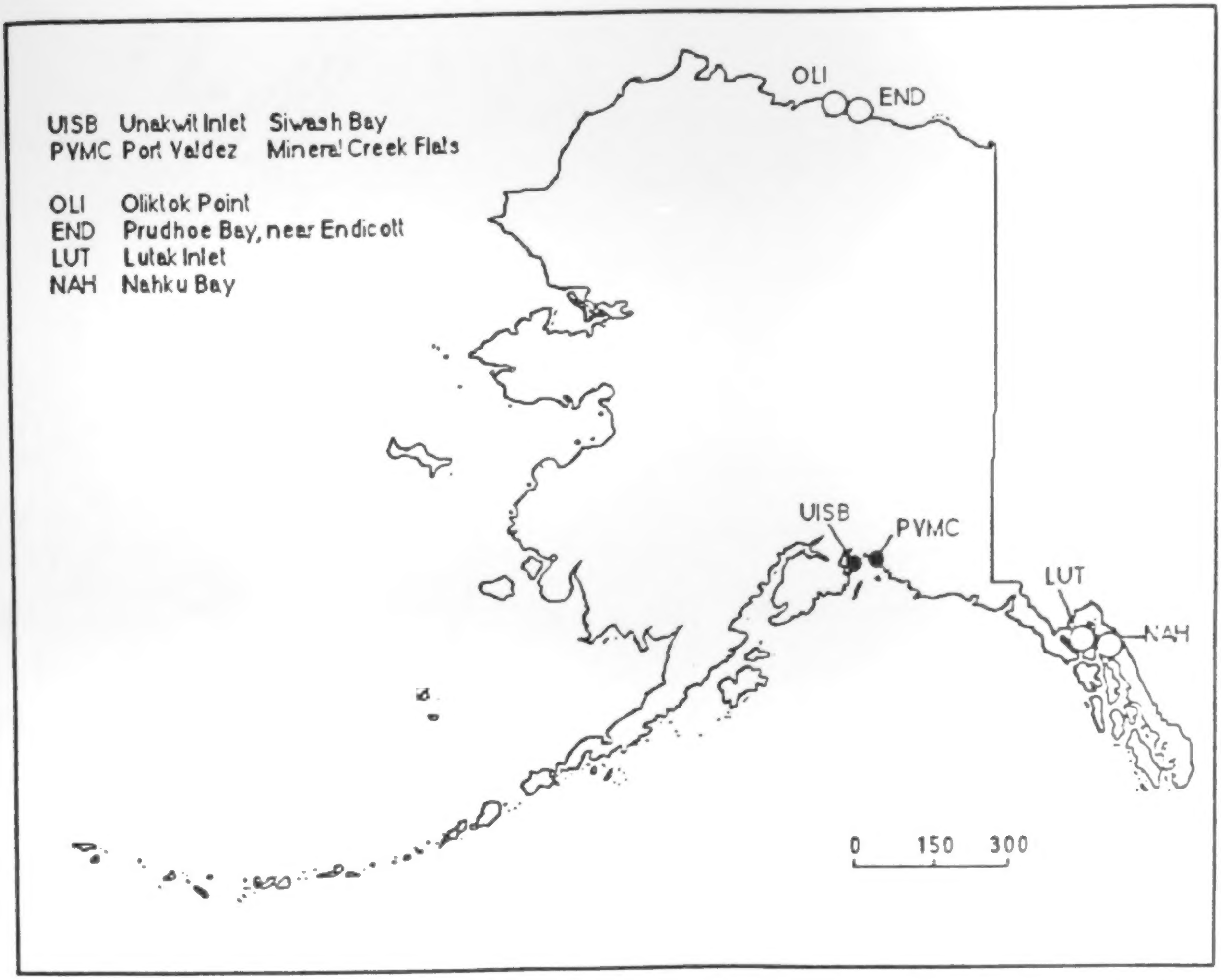


Figure 8.2: BENTHIC SURVEILLANCE SURVEY SITES


UISB Unakwit Inlet Siwash Bay
PVMC Port Valdez Mineral Creek Flats
OLI Oliktok Point
END Prudhoe Bay, near Endicott
LUT Lutak Inlet
NAH Nahku Bay
OLI
END
UISB
PVMC
LUT
NAH
0
150
300

Alaska

igure 8.3: BENTHIC SURVEILLANCE SURVEY & MUSSEL WATCH SITES

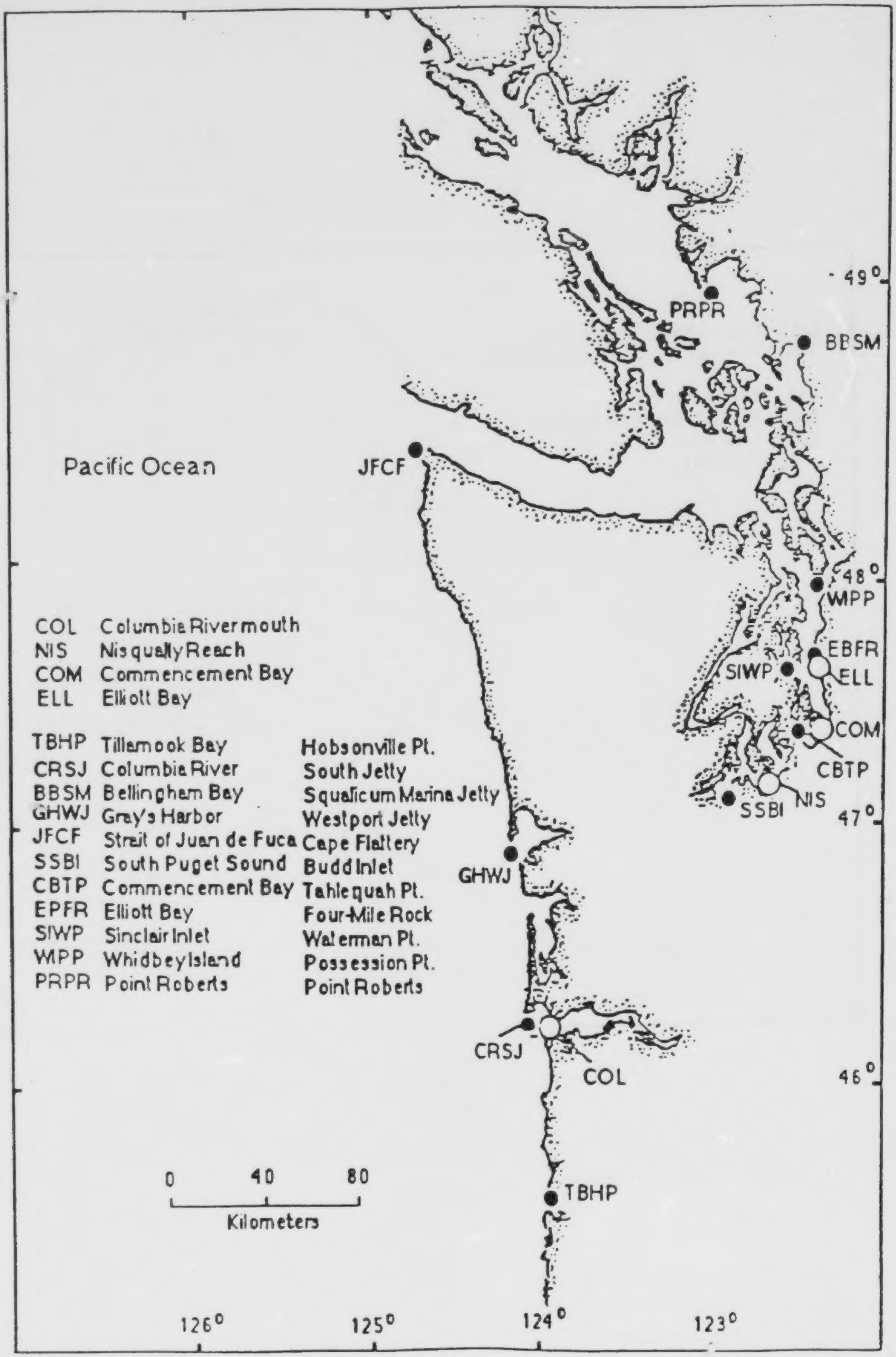
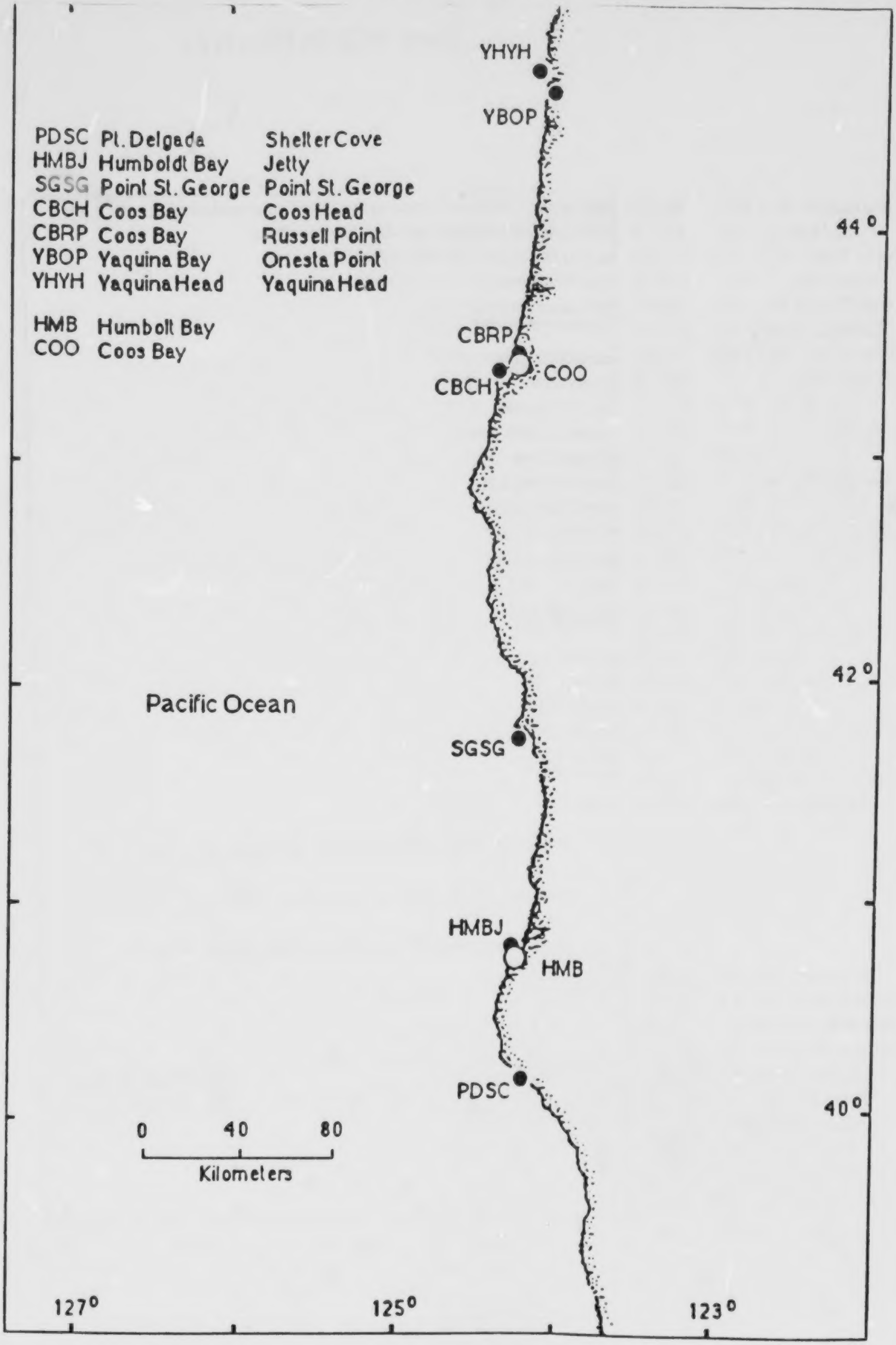

Pacific Ocean
PRPR
BBSM
JFCF
WPP
EBFR
SIWP
ELL
COM
CBTP
NIS
SSBI
GHWJ
CRSJ
COL
TBHP
49°
48°
47°
46°
126°
125°
124°
123°
0
40
80
Kilometers
COL Columbia Rivermouth
NIS Nisqually Reach
COM Commencement Bay
ELL Elliott Bay
TBHP Tillamook Bay Hobsonville Pt.
CRSJ Columbia River South Jetty
BBSM Bellingham Bay Squalicum Marina Jetty
GHWJ Gray's Harbor Westport Jetty
JFCF Strait of Juan de Fuca Cape Flattery
SSBI South Puget Sound Budd Inlet
CBTP Commencement Bay Tahlequah Pt.
EPFR Elliott Bay Four-Mile Rock
SIWP Sinclair Inlet Waterman Pt.
WPP Whidbey Island Possession Pt.
PRPR Point Roberts Point Roberts

Figure 8.4: BENTHIC SURVEILLANCE SURVEY & MUSSEL WATCH SITES

Northwest Pacific Coast


YHYH
YBOP
PDSC Pt. Delgada Shelter Cove
HMBJ Humboldt Bay Jetty
SGSG Point St. George Point St. George
CBCH Coos Bay Coos Head
CBRP Coos Bay Russell Point
YBOP Yaquina Bay Onesta Point
YHYH Yaquina Head Yaquina Head
HMB Humbolt Bay
COO Coos Bay
44°
CBRP
COO
CBCH
42°
Pacific Ocean
SGSG
HMBJ
HMB
PDSC
40°
0 40 80
Kilometers
127°
125°
123°

Point Delgada to Yaquina Head

ure 8.5: BENTHIC SURVEILLANCE SURVEY & MUSSEL WATCH SITES

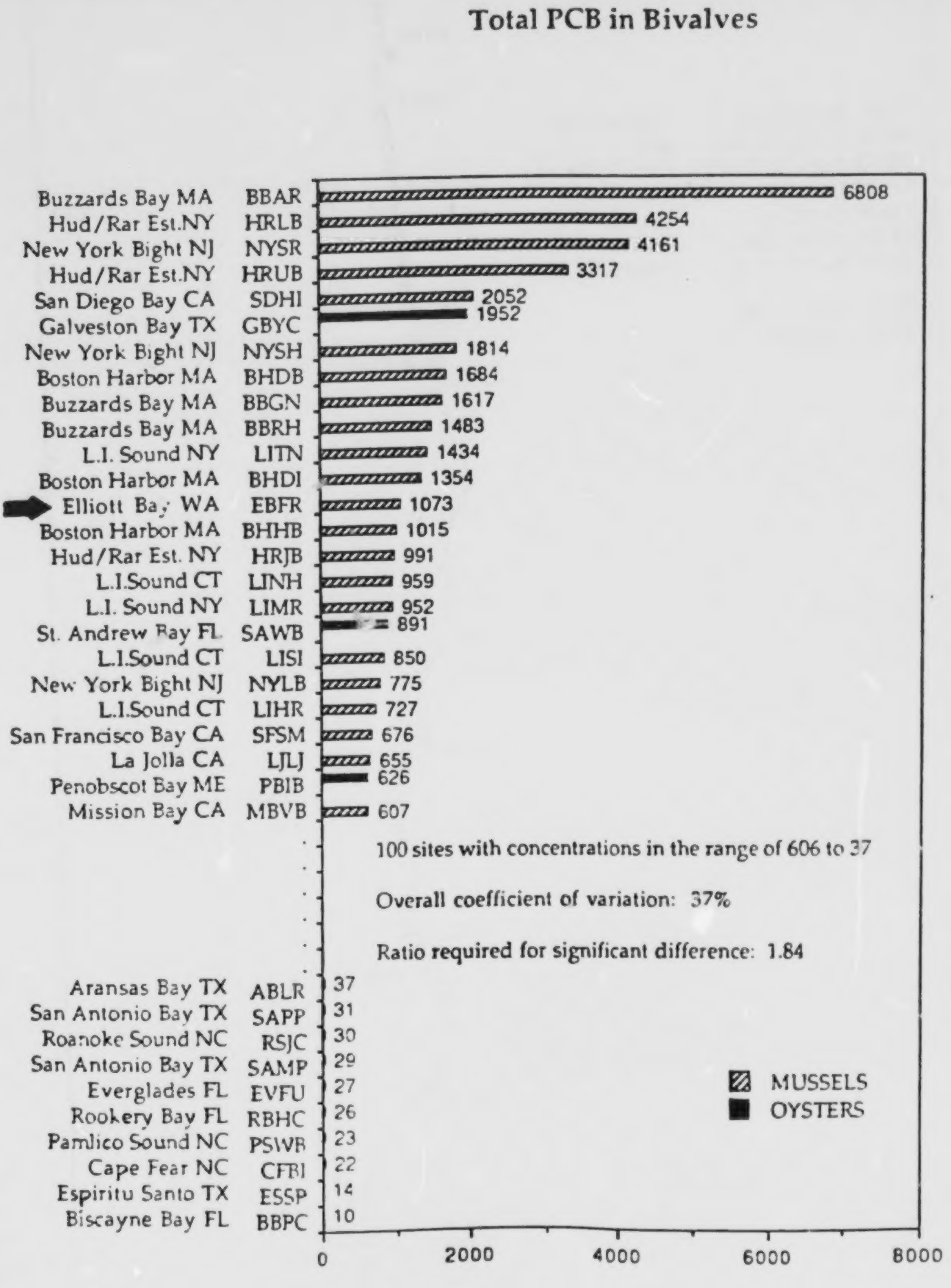


Figure 8.6: MUSSEL WATCH SITES

Monitoring Program (PSAMP). In April 1988, the Committee presented its recommendations to the Authority, and, following review and approval, PSAMP is expected to be incorporated into the 1989 Puget Sound Water Quality Management Plan. Eventually, PSAMP will incorporate monitoring data into a data management system accessible by interested agencies. Due to differences in protocols, data from the NS&T Program are not expected to be included in the PSAMP. Therefore, the Region 10 PCB Program will track information available from both programs.

2. PCB Compliance

Description

This indicator addresses violation categories concerning PCB non-compliance to determine if there have been any historical trends. The group chosen for the indicator was utilities because they: 1) have substantial quantities of PCB equipment (and, thus, have better potential for all types of violations); 2) have been the focus of a special education/outreach/ enforcement program; and 3) represent a large enough share of our PCB inspections so that the analysis results have statistical significance. The analysis involved examining case review results for all utility inspections in a 3-year period, and comparing the first 18 months to the last 18 months of this period.

Limitations

The analysis did not attempt to factor in "degrees" of violation. For example, a disposal violation for an ounce of PCBs counted the same in the analysis as a similar violation for a larger quantity of PCBs.

Discussion

The following trends/conclusions are derived from Table 8.1:

- *Noncompliance has held constant at just over 50%.*
- *Proportionally fewer Complaints and more Notices of Noncompliance (NON) were issued in Period B than Period A; however, this is partially explained by the fact that during the latter period we also raised the threshold between a NON and a Complaint from $1,500 to $5,000, i.e., if the sum of the violation(s) is equal to or greater than $5,000, a complaint is issued; if less than $5,000, a NON is issued. This threshold was formerly $1,500.*
- *The proportions and types of violations cited held fairly constant except for quarterly inspection violations (which fell significantly) and storage violations (which increased significantly). There is no readily apparent explanation for these changes.*
- *There were more violations per complaint during Period B than Period A and this generally means that the amount of penalties per complaint has increased. (In addition, a number of complaints more recently have been for repeat violators which triggers automatic penalty markups).*
- *We have not had a significant incidence of violations of the "Fires Rule."*

During the two 18-month periods examined (1/85-6/86, and 7/86-12/87), there were close similarities in terms of numbers of inspections, rates of noncompliance, and total numbers of violations found. Although there have been some changes in numbers of violations in certain categories, the overall consistency in results is striking. This does not mean that EPA and the regulated community have failed to improve the compliance rate so much as that the regulations have continued to grow in volume and complexity, our inspectors have become more proficient, and the regulated community has generally mastered the basics and is now committing more "sophisticated" violations. It also underscores the fact that as long as a facility continues to use PCB equipment, and even if it has a good compliance program, it is hard to be constantly in compliance.

Results

Table 8.1

Summary of Historical Patterns of Violation of the PCB Regulations by Electric Utilities in Region 10

	Period A	**Period B**
Dates	**1/85 - 6/86**	**7/86 - 12/87**
No. of Inspections	**35**	**33**
Disposition:		
-No Violation or Advisory	16	15
-Notice of Noncompliance	2	7
-Civil Complaint	17	10
-Review Pending	-	1
Rate of Noncompliance	54%	52%
Type and Number of Violations Cited in Complaints:		
-Disposal	33	30
-Records	19	16
-Marking	18	16
-Quarterly Inspections	11	1
-Storage	8	17
-"Fires Rule"	N/A*	3
Total	**89**	**83**
Average No. of violations/complaint	5+	8+

* *Did not go into effect until 12/85 and inspections for compliance not emphasized until mid 1986.*

Future Directions

While it was an interesting exercise to examine these compliance patterns, it mainly served to confirm perceptions already held by Toxic Substances Section staff. It may be a good crosscheck to perform in a few years, but a repeat analysis in the near term would be unlikely to yield any additional insights.

3. PCB Early Disposal Survey

Description

In settlement of PCB administrative complaints, we have a working policy of allowing some credit against financial penalties for environmentally beneficial expenditures which go beyond the requirements of the regulations. One type of allowance is partial credit for disposal costs if the respondent agrees to properly get rid of regulated equipment prior to the end of its useful life, or to retrofill/reclassify the equipment using an EPA permitted method to reduce PCB content. On a quarterly basis, we have reviewed all new PCB settlements to tabulate how much regulated equipment has received "early disposal."

Limitations

Early disposal ensures that PCBs are subtracted from the total in-use inventory, thus decreasing the potential of their getting into the environment. However, since future life cycle incidents (possible spills, leaks, explosions, and improper disposal) for a particular piece of equipment cannot be predicted, the environmental benefit can only be assumed, not demonstrated.

Results

Table 8.2

FY 88 PCB Equipment Early Disposal (Includes Retrofill/Reclassification)

Qtr	Respondent	# Transformers Disposed of	# Capacitors Disposed of	Other
1	Pacific NW Broadcasting (Boise, ID)	4 PCB	10	
1	Oregon Inst. of Technology (Klamath Falls, OR)			Retrofill/Reclassify 1 PCB transformer
1	Benton Rural Electric (Prosser, WA)			Reclassify 1 PCB transformer using permitted process
2	Idaho Power (Boise, ID)			Spend at least $50,000 for early disposal of PCB & PCB contaminated equipment
2	General Metals (Tacoma, WA)	4 PCB; 4-PCB Contaminated		
3	Nu-West Industries (Conda, ID)			Retrofill/Reclassify 19 PCB transformers
3	Weyerhauser Co. (Longview, WA)			Spend at least $20,000 for early disposal of PCB transformers
3	Puget Sound Plywood (Tacoma, WA)			Spend at least $5600 for early disposal of PCB capacitors
4	Univ. of Alaska (Fairbanks, AK)	11 PCB		
4	Captain Cook Hotel (Anchorage, AK)			Spend at least $30,000 towards retrofill or disposal of PCB transformers
4	Chugach Electric (Anchorage, AK)			Spend at least $56,000 towards disposal of PCB items
4	Salmon Bay Steel (Kent, WA)	1 PCB; 1 PCB-Contaminated		
4	Intalco Aluminum (Ferndale, WA)			Retrofill/Reclassify 4 PCB transformers

Discussion

Table 8.2 lists PCB equipment which has been (or is to be) disposed of or retrofilled/reclassified as a result of FY 88 settlement agreements. It is difficult to summarize or draw conclusions about the data due to the individual nature of various agreements. The main reason for this is that a number of agreements allow the respondent to select equipment for disposal or treatment over a period of time. In such cases, the respondent agrees to expend a certain amount of money and to report expenditures and equipment to EPA at the end of the agreed-on period. It can be noted that the 13 cases listed involving early disposal constituted about 37% of the 35 PCB cases settled for penalties in FY 88.

Future Directions

We will continue to track early disposal during FY 89 in order to at least determine if this is an area for continuing emphasis.

Toxics Environmental Indicators for PCBs
FY 89 and Beyond

We have added to and revised the set of environmental indicators for PCBs.

1. **PCB Early Disposal Survey:** Track quarterly equipment disposed of as part of settlement agreements
2. **PCB Early Disposal by BPA:** Analyze data included in BPA's PCB Annual Report and prepare analysis summary
3. **PCB Levels in Biota:** Continue contacts with other agencies on a quarterly basis and prepare year-end report

The PCB compliance indicator will be revisited in FY 90 when new insights may be gained from the exercise.

Environmental Indicators for Asbestos
FY 88

1. Asbestos In Schools Program

Asbestos removed or encapsulated (square and lineal feet) as the result of negotiated settlements of civil complaints issued to Local Education Agencies (LEA)

2. Asbestos Hazard Emergency Response Act (AHERA Program)

Asbestos Abatement in Schools in Oregon (square and lineal feet) resulting from abatement activities after the effective date of AHERA (December 14, 1988)

1. Asbestos-In-Schools Program

Title of Environmental Indicator

Asbestos removed or encapsulated (square and lineal feet) as the result of a negotiated settlement of a civil complaint issued to a Local Education Agency (LEA).

Limitations

A large proportion of LEAs with friable asbestos-containing materials (FACM) took some action to reduce exposure during the period of 1979 to 1988. These actions were primarily a result of: EPA's technical assistance program, EPA's TSCA compliance program, or public pressure (a public informed by publicity surrounding EPA's programs). No data have been compiled regarding abatement activities other than those activities associated with enforcement actions. Further it is only those enforcement actions resulting in civil complaints where EPA has compiled data about exposure reduction. The 61 civil complaints settled in the 1986-87-88 fiscal years represent about 2% of the total Region 10 student population. It should be clearly understood that this report attempts to show the effectiveness of only one small part of an overall program. The actual impact of those complaints has gone far beyond the schools directly involved, in that many other LEAs were likely influenced by those actions to undertake abatement on their own.

Also, the asbestos-in-schools program covers only a small portion of the asbestos in buildings, homes, and industrial facilities.

Background

EPA'S Asbestos-in-Schools Program was the result of a combination of legislative and regulatory actions taken in response to increased awareness of health risks associated with asbestos exposure. Most of the health risk data concerning asbestos had been developed from the high dose long exposure situations found in manufacturing and industrial situations. The Occupational Safety and Health Administration (OSHA) regulations were promulgated to protect workers from such exposure.

EPA's early regulatory efforts were aimed at protecting the quality of ambient air (NESHAPs) and protecting school children (as they may not be adequately protected by regulations written to protect adult workers).

There were very little data available to show the health risks of exposure at the levels and durations experienced by school children. It was generally agreed by scientific researchers that there was no known threshhold-level below which exposure to asbestos was not a potential health hazard. There were documented cases where children of asbestos manufacturing workers developed asbestos diseases when exposed to levels which could be similar to the exposure a school child would experience if air-borne friable asbestos was present due to deterioration, maintenance, damage, or construction activities in the school. Definitive studies of the effects of the presence of asbestos in schools may take 30-40 years to complete because of the long latency periods of asbestos-related diseases.

Because the definitive risk studies are not available, the evaluation of effectiveness of the Asbestos-in-Schools Program was inferred through the documentation of ***reduction of the potential for exposure which reduces the opportunity for health risk***.

The Region's Asbestos-in-School's Program reduces the potential for exposure in several ways. TSCA regulations require the schools to inspect for any friable asbestos-containing material (FACM), analyze samples of suspect material (or assume, absent testing, that the material is asbestos-containing), and notify staff and parents of inspection/analysis results. All 1543 Region 10 local education agencies (LEAs) were required to be in compliance with these regulations by June 1983.

As of the end of fiscal year 1988, the Region had conducted 793 compliance inspections at LEAs. With rare exception, all of these LEAs are presently in compliance; some are in compliance because they responded to the issued regulation, some because of pending EPA inspections, some because of pressure from parents, some because of fear of adverse publicity, and some because of enforcement efforts by EPA. The overall rate of noncompliance was 48%. However, only 8% actually received complaints for significant violations; the remaining 45% were out of compliance for minor violations (such as failure to complete the form required when no FACM was present).

In nearly every case, school administrators agreed there was a need to reduce risk through minimization of human exposure to friable asbestos-containing material, using abatement measures such as removal or other methods for controlling FACM. However, this was not always the highest priority for a LEA. The major impact of enforcement activities has been to change LEA priorities and thus to reduce potential exposure sooner than might otherwise happen.

This report examines the results of asbestos abatement activities associated with the 61 Asbestos-in-Schools complaint settlements that occurred in Region 10 during FY 86, 87, and 88.

Enforcement Element

In cases where an LEA was substantially out of compliance either at the time of inspection or for at least a year's period after the June 1983 effective date, EPA issued a civil complaint with a proposed penalty assessment. Generally, the proposed penalties for a violative LEA were $6,000.00 per school out of compliance with an additional $6,000.00 to a large LEA for failure to bring individual schools into compliance. In nearly every case, failure to be in compliance translated into failure to have notified parents and/or staff of friable material.

Cases were informally settled through negotiations with the Regional Asbestos Coordinator operating under advice of Office of Regional Counsel; none have proceeded to hearing before an Administrative Law Judge. The basic policy, consistent with EPA HQ direction, was to reduce the proposed penalty to a fixed minimum, based upon the LEA's agreement to provide at least dollar for dollar abatement for the amount of reduction of proposed penalty. In those few cases where the cost of ***complete*** abatement was less than the deferred portion of the proposed penalty, full credit was given for the deferred amount.

Methodology

Data for the analysis were compiled by phone survey. Each LEA was asked to estimate the amount of asbestos abated (encapsulated or removed) to meet the deferred portion of the settlements. There was great variation in the reported cost of abatement due to conditions, contractors, and methods of financing. Reported costs of abatement range from less than one-dollar to over forty-dollars per square/lineal foot.

In those cases where data were incomplete, i.e., only dollar amounts or quantities of abatement were reported (but not both), a cost factor of eight-dollars per square/lineal foot was used for estimation purposes. The eight-dollar figure was selected on the basis of industry estimates since this was believed to be more reliable than other options, such as averaging the wide-ranging data from the rest of our sample.

Conclusions

The sixty-one civil complaint settlement cases of FY 86, 87, and 88 resulted in proposed penalties totaling $469,000. Deferred penalties totaled $431,000. The deferment of the $431,000 was negotiated through informal settlement conferences in exchange for asbestos abatement including both removal and encapsulation. Total expenditure for abatement was $1,408,000 for the 61 settled cases. Therefore, for every dollar deferred, $3.46 was spent by LEAs for abatement.

The abatement projects resulted in abatement of approximately 372,000 square feet of sprayed-on asbestos and 9,000 lineal feet of pipe wrapping; 126 schools had asbestos abated resulting in about 37,300 students and staff benefitting from reduced asbestos exposure.

Future Directions

With the promulgation of final regulations for the Asbestos Hazard Emergency Response Act (AHERA) on December 14, 1987, Region 10 has entered a new phase in the Asbestos Program for schools. Since the new program will ***require*** abatement of all friable asbestos, we can expect large increases in the amount of hazard removed. The rules require the abatements to begin by July 1989.

Table 9.1

AIS FY 86, FY 87 & FY 88 Summary of Abatement After Settlement

	No. of Schools	No. of Students	Proposed Penalty $	Deferred Penalty $	Penalty $	Dollars for Abatement	Sq. Ft Abated	Lin. Ft. Abated	Schools Abated	Students Affected
FY 86 Totals	90	24,000	171,000	157,000	16,000	235,000	233,000	1,150	40	10,300
FY 87 Totals	83	24,000	145,000	133,000	11,500	1,017,000	120,000	7,200	54	17,000
FY 88 Totals	52	15,000	153,000	141,000	13,000	156,000	19,000	650	32	10,000
Grand Total	**225**	**63,000**	**469,000**	**431,000**	**40,500**	**1,408,000**	**372,000**	**9,000**	**126**	**37,300**

Total Region 10 Student Enrollment: 1,700,000

2. AHERA Program

Title of Environmental Indicator

Asbestos abatement in schools in Oregon (square and lineal feet) resulting from abatement activities after the effective date of AHERA (December 14, 1988).

Note: *This indicator was revised as per discussions with the Deputy Regional Administrator. See* **"Environmental Indicators for Asbestos–FY 89 and Beyond"** *at the end of this chapter for the new indicator.*

Description

Asbestos is a health hazard when asbestos fibers become airborne and thus are able to be inhaled. The condition of being able to release fibers is called being "friable." The AHERA reflects Congress's concern that school children be protected from asbestos fibers. The AHERA regulations require schools to inspect for asbestos-containing material, determine the condition (whether or not it is or is not capable of becoming friable), and repair, encapsulate, or remove that which is a serious health hazard (friable and significantly damaged).

The nature of asbestos is that, while asbestos is a proven carcinogen, the exposure levels which result in disease are not well documented. The assumption inherent in AHERA is that ***the abatement of friable asbestos will reduce potential health hazards***.

The AHERA regulations require that asbestos management plans be submitted to each State Governor's Designee. These management plans include a description of the abatement actions (repair, removal, encapsulation) planned to be taken after December 14, 1988.

The State of Oregon was chosen because the Governor's Designee has developed a computer system which will make compilation of data easier. One state was chosen as an indicator in an effort to reduce the resource commitment of collecting data.

Limitations

The indicator does not tell us the actual reduction in hazard. Rather, it tells us the reduction in potential hazard. For example, 90% of the asbestos could be removed from a school building but the remaining 10% could, if mishandled, cause serious health hazards. Asbestos related diseases have very long latency periods and the actual reduction in hazard will take many years to evaluate.

Presentation of Data

The data will begin to be available after January 1, 1989. However, an extension is available to allow schools to delay reporting until May 9, 1989. We anticipate presenting the data in the form of a graph showing the amount of abatement taking place over time.

Future Directions

AHERA is new legislation with requirements for asbestos abatement. The previous regulations (Asbestos-in-Schools) required only inspections and, except for enforcement cases, abatement was voluntary. This indicator covers a much larger segment of the problem than does the earlier indicator. Previous indicators tabulated only asbestos removal resulting from settlement cases. The new indicator will tabulate all reported abatement undertaken at schools regardless of the motivating factors behind the abatement.

Environmental Indicators for Asbestos
FY 89 and Beyond

AHERA Compliance: Collect data on schools' compliance with various program deadlines

Chapter 10: Pesticides

Pesticides Environmental Indicators
FY 88

1. **National Drinking Water Well Survey (EPA)**
2. **National Bioaccumulation Study (EPA)**
3. **Public complaint data (State pesticide programs)**

Background

Because FIFRA does not provide funds for environmental monitoring, EPA and state pesticide programs have not been able to routinely monitor the environment for the presence of pesticides. Unable to execute a monitoring program of our own in Region 10, we are forced to rely upon other resources. As it becomes available, we can review sampling data that is generated by other EPA programs and governmental agencies for the presence of pesticides. Routine regulatory activities performed by the states may also serve as indirect indicators of environmental change. However, the many assumptions that have to be made about regulatory indicators limit their utility as reliable indicators.

During FY87, the Pesticides Program selected the following three environmental indicators to help us monitor pesticide exposure in Region 10 states. The first two indicators will show actual pesticide levels in the environment. The third indicator, a regulatory activity, will help us evaluate the kinds of pesticide exposure that occur during routine applications.

1. **National Drinking Water Well Survey** (EPA)
2. **National Bioaccumulation Study** (EPA)
3. **Public Complaint Data** (State pesticide programs)

The Drinking Water Well Survey and the National Bioaccumulation Study will survey pesticide concentrations nationwide and provide, for the first time, national data baselines. These two studies present an opportunity for us to track where contemporary pesticides are appearing and seem to persist in the environment. Results of these studies should help us determine where in Region 10 we need to be concerned about chronic exposure to pesticides through our drinking water or the fish and shellfish we consume.

Unfortunately, neither of these studies was conceived as an ongoing monitoring program. Since it is unlikely that either study will receive additional funding, we would need to tap other programs to carry out further research. Should these two studies reveal unacceptable pesticide levels in Region 10, we will try to generate additional monitoring support through existing EPA and state programs.

Public complaints about pesticide problems that state pesticide programs receive from the general public represent an unspecifiable percentage of all acute, short-term pesticide risks that arise from improper pesticide disposal and application. These complaints therefore present a limited perspective about how and where acute pesticide exposure is occurring. Region 10 states routinely focus their program priorities on the types of recurring pesticide uses that arouse public complaints and present the greatest damage and exposure risks.

1. National Drinking Water Well Survey

The impetus for this study comes from EPA's growing concerns about ground water contamination. Since 1975, urban water systems have only been required to monitor for six pesticides: endrin, lindane, methoxychlor, toxaphene, 2,4-D, and 2,4,5-T. Recent evidence, however, indicates a larger problem of pesticides in ground water. To date, 73 pesticides used primarily in agricultural practices have been found in ground water in 34 states.

This nationwide study has two major objectives: (1) to determine the degree to which the drinking water wells of the nation are contaminated by pesticides; and (2) to better understand how pesticide concentrations in drinking water wells are associated with patterns of pesticide usage and the vulnerability of ground water to pollution. The data will help develop inferences about populations potentially at risk from exposure to pesticides in drinking water wells. The study will provide information to help EPA better target pesticides of concern and develop further regulatory initiatives where necessary. It may be necessary in the future for the States to adopt regulations that govern the use of pesticides in areas where drinking water supplies are determined to be highly vulnerable to pesticides.

The study will analyze drinking water well samples for the 120 pesticides listed in Appendix 1. In Region 10, private wells in Idaho, Oregon and Washington and twenty-nine community wells (see Appendix 2) are scheduled for sampling. In 1987, sampling protocols and analytical methods specially designed for this study were tested through a pilot study of 48 wells in California, Minnesota, and Mississippi.

Results from this study will not be available until late 1989 at the earliest. A final report is expected during 1990. Region 10 will begin its evaluation during 1990 and will also share the findings with state pesticide programs.

2. National Bioaccumulation Study

This 1988 study is investigating the bioaccumulation of selected toxic pollutants in fish and shellfish. It is focusing on pollutants, including some cyclodienes and organophosphates, which pose potential human health threats primarily because they tend to bioacccumulate and contaminate fish and shellfish. Bottom fish, crabs, oysters and salmon will be tested. A mixture of whole body and fillet tissues will be analyzed.

The monitoring scheme uses a combination of existing ambient monitoring networks, relatively undisturbed background areas, and areas with high industrial or agricultural activity. A total of sixty-nine freshwater and estuarine sites were selected for sampling in Region 10: Alaska (10), Idaho (13), Oregon (17) and Washington (29). Tissues will be analyzed for the 60 analytes listed in Appendix 3.

Only the analysis results for dioxins are now available. The pesticides analysis will not be completed until sometime during 1989. We plan to work with our toxicologist and other EPA staff to evaluate the findings. Perhaps the most difficult aspect of using this indicator will be tracking the source of pesticide contamination. Pesticides dissolved by surface waters or adsorbed to sediments can be transported unpredictable distances from the original site of application. While this study may show unacceptable levels of pesticides in fish or shellfish, it will fail to serve adequately as an environmental indicator unless the source of pesticides can be identified. If the source can be identified and regulated, we might be able to establish monitoring networks that truly measure the effect of this and other EPA programs on the levels of pesticides found in these aquatic species over time.

At this time, we do not have the resources in the pesticides program to perform an extensive search for sources of pesticides contamination. We propose to discuss any significant pesticide contamination problems with the appropriate hazardous waste and water programs, as well as with various state agencies, to determine their interests and abilities to search for and correct the cause and/or to monitor the situation.

3. Public Complaints

In order to establish program priorities each year, Region 10 states review and rank the types of pesticide complaints that were investigated during the previous year. Frequency, pesticide toxicity, the method of application and the degree of damage caused to humans or the environment are some of the factors considered during this ranking process. Appendices 4 and 5 demonstrate how Idaho and Washington set their priorities. The states and EPA Region 10 negotiate enforcement agreements annually based partially upon the results of this priority-setting process. Both programs work cooperatively to try to reduce the risks, as expressed through public complaints, caused by pesticide damage and exposure. Field inspections, enforcement, and education through applicator training courses are the primary regulatory tools used. Comparison of public complaint data each year helps us assess how well these tools are working.

Drift from pesticide applications, particularly aerial drift, continues to remain the most frequent cause of public complaint in Region 10. The states plan to hold more specialized training seminars for aerial applicators and will also target some field inspections toward aerial applicators. The states may also adopt special application restrictions. For example, Washington recently required aerial applicators that want to spray phenoxy herbicides near certain areas of the Yakima valley to first obtain a special permit. Phenoxy herbicides used in these areas have persistently drifted to and damaged nearby grape orchards, and have recently affected residential gardens.

Complaints about the commercial application of insecticides inside the home and herbicides on lawns and ornamental trees have been increasing. Being applied in residential areas, this type of pesticide misuse presents perhaps the highest potential human health risk. The states are directing more use inspections toward this application category.

A significant increase in EPA and/or state funding of the state pesticide enforcement and applicator training efforts is needed before we can have much additional impact on reducing these problems. The recent reduction in enforcement funds has made it difficult not to actually lose ground in this area. We propose to continue to negotiate for as many inspections as possible to be targeted to reducing the high-priority problems, and to assist in upgrading applicator certification programs. In addition, depending on resource availability, our comparative risk strategy effort will focus over the next several years on developing information and training to reduce the risk of pesticide exposure to farm workers.

Other Pesticide Studies Reviewed for Potential Environmental Indicator Data

Environmental Services Division, EPA Region 10 - Our Environmental Services staff may sample specific areas in Region 10 upon request by state and local governments. They also help design and execute monitoring plans for national or regional initiatives like the National Bioaccumulation Study. The Pesticide Program periodically reviews the results of such studies for significant levels of pesticide residues.

Most studies in which ESD participates cannot be used as environmental indicators. They provide only a one-time snapshot of the environmental conditions at a given site and do not demonstrate how conditions at that site change in response to regulatory actions. Continuous monitoring data is needed to accurately measure the impact of regulatory activities on environmental conditions over time. Nonetheless, ESD studies can help us identify geographical areas in Region 10 where additional research into pesticide use patterns may be needed. The following studies were reviewed during FY88.

Washington Sediment Watch - Many different governmental agencies participate with ESD in this monitoring network. Analysis of soils collected at Whatcom Creek near Bellingham, Washington and Wide Hollow Creek near Yakima, Washington showed concentrations as high as 290 ug/kg for endosulfan and 340 ug/kg for MCPA. These samples were drawn during July 1987 at the height of the growing season. These levels would be expected close to the time of application. Additional samples, drawn before the spring spraying season and runoff begins would be needed to determine whether these are indeed problem sites. Findings from the Yakima River Basin study being conducted by USGS should help us further evaluate the Yakima site. Illegal disposal of pesticides is a possible cause.

Miller Bay, Suquamish, Washington - Bottom sediment samples were taken from Miller Bay during February 1988. A cancelled herbicide, 2,4,5-T, was found at 42 ug/kg. Similar low levels of dinoseb, pentachlorophenol and 2,4-D were also found. We are presently considering whether additional research about how these particular pesticides came to rest at this site is merited, and how it could be conducted.

USGS Yakima River Basin Study - This is one of four pilot studies being conducted in the United States. Water column samples were taken at eight locations along the Yakima basin from its headwaters near Cle Elum, Washington to below the town of Yakima. The samples were gathered periodically throughout the year to determine what pesticides are present and when they are prevalent. Only one sediment sample was scheduled during August when the Yakima River is at its lowest level. The analytes include various carbamates, organochlorines, and triazines. The Cooperative Extension Service supplied information regarding which pesticides are commonly used in the basin. Most analysis results and an abstract should be available before the end of 1988.

Puget Sound Estuary Program - A 1988 study titled "Pesticides of Concern in the Puget Sound Region" provides an estimate of the amounts of contemporary pesticides applied around Puget Sound. It identified pesticides of concern by assessing the amounts and distribution of pesticides used and their potential to migrate to the aquatic environment. Based upon an evaluation of characteristics such as mobility, persistence and amounts used, the study suggests that primary concern should be placed upon the following pesticides:

In Marine/Riverine Waters	*In Sediments*
2,4-D	**pentachlorophenol**
dicamba	**prometon**
alachlor	**simazine**
tributyltin	**tebuthiuron**
bromacol	**chlorpyrifos**
atrazine	**diuron**
triclopyr	**glyphosate**
carbaryl	**trifluralin**
malathion	**phorate**
	fenvalerate
	methyl bromide
	chlordane
	disulfoton

The study also suggested a sampling strategy. Sediment and water column samples were gathered from several sites in the major Puget Sound watersheds during summer 1988 (see Appendix 6). Most of the pesticide analytes will be analyzed for in concentrations of parts per billion. Appendix 7 lists the analytes that were selected.

The information produced by this and subsequent monitoring efforts will bring us closer to understanding which pesticides threaten marine organisms in Puget Sound and may also pose a human health risk to those who consume contaminated fish and shellfish.

Summary

Clearly, the lack of any routine monitoring for pesticides limits the scope of pesticide environmental indicators in the Region. We are hopeful that the above-mentioned studies will stimulate interest by those programs and agencies with funding, staff, and legislative authority to initiate routine monitoring of pesticides, particularly in known or suspected problem spots.

Pesticide Environmental Indicators FY 89 and Beyond

1. **Drinking Water Well Survey**
   Well sampling should be completed by the close of FY 89. Results will not be available until FY 90.

2. **National Bioaccumulation Study**
   Results were received March 1989. They are being analyzed now.

3. **Public Complaint Data**
   We will again summarize the priorities set by each state for FY 90 grant programs to determine what pesticides and which modes of application most frequently result in unsafe pesticide exposure.

   Note: *Over the next two to three years, the states will be developing their ground water protection programs and gathering data about pesticide use patterns. We may find this information useful as an indicator of how well the controls eventually placed upon pesticide use by the states and/or EPA actually prevent further contamination of ground water resources.*

   Region 10 is also conducting a special study on worker protection exposure during Summer 1989. This study may produce data that we can use as a measure of human exposure. We will need to follow-up with long-term monitoring programs, however, to be able to use this information as an indicator of the change in exposure levels before and after enforcement of the new worker protection regulations.

In addition, the program plans to review the following sources of information concerning the presence of pesticides in various Region 10 locations.

USGS Yakima River Study - We will attempt to compare interim study results with freshwater fish toxicity thresholds and other EPA water quality guidelines to evaluate if and when safe levels of pesticides are exceeded.

Spokane County Health District - We will monitor their cholinesterase testing program.

Puget Sound Program - Final results of last summer's sampling program were received in April 1989. Three pesticides were found in low concentrations. We will work jointly with ESD and the Puget Sound program to determine whether further study is needed.

ESD Sediment Watch - We will continue to meet periodically with ESD staff to see if any significant pesticide levels have been discovered.

Worker Protection - In September 1989, we will begin reviewing and evaluating human exposure data gathered via the special Region 10 study.

Appendix 1

Pesticides Included in the EPA National Pesticide Survey, April 14, 1988

Acifluorfen*
Alachlor*
Aldicarb*
Aldicarb sulfone*
Aldicarb sulfoxide*
Diuron*
Ametryn*
Atraton
Atrazine*
Atrazine, dealkylated metabolite
Barban
Baygon*
Bentazon*
Bromacil*
Butachlor
Butylate*
Carbaryl*
Carbofuran*
Carbofuran phenol
Carbofuran phenol-3KET
Carbofuran-3OH
Carboxin*
Chloramben*
Chlordane-alpha*
Chlordane-gamma*
Chlorneb
Chlorobenzilate
Chlorothalonil*
Chlorpropham
Cyanazine*
Cycloate
2,4-D*
Dalapon*
2,4-DB
DBCP*
DCPA
DCPA diacid metabolite
4,4'-DDD
4,4'-DDE
4,4'-DDT

Demeton-S
Diazinon*
Dicamba*
3,5-Dichlorobenzoic acid
1,2-Dichloropropane*
cis-1,3-Dichloropropene*
trans-1,3-Dichloropropene*
Dichlorprop
Dichlorvos
Dieldrin*

Dinoseb*
Diphenamid*
Disulfoton*
Sisulfoton sulfone
Sisulfoton sulfoxide
Picloram*
EDB*
Endosulfan I
Endosulfan II
Endosulfan sulfate

Endrin*
Endrin aldehyde
EPTC
Ethoprop
Etridiazole
ETU*
Fenamiphos*
Fenamiphos sulfone
Fenamiphos sulfoxide
Fenarimol
Fluometuron*
Fluridone
HCH-alpha
HCH-beta
HCH-delta
HCH-gamma
Heptachlor*
Heptachlor epoxide*
Hexachlorobenzene*
Hexazinone*
5-Hydroxy Dicamba
Linuron
Merphos
Methiocarb
Methomyl*
Methoxychlor*
Methyl paraoxon
Metolachlor*
Metribuzin*
Metribuzin DA

Metribuzin DADK
Metribuzin DK
Mevinphos
MGK 264
Molinate
Napropamide
Neburon
Nitrates/Nitrites*
4-Nitrophenol
Norflurazon

Oxamyl*
PCP
Pebulate
cis-Permethrin
trans-PermethrinAldrin

Prometon*
Prometryn
Pronamide*
Pronamide

Propachlor*
Propanil
Propazine*
Propham*
Simazine*
Simetryn
Stirofos
Swep
2,4,5-T*
Tebuthiuron*
Terbacil*
Terbufos*
Terbutryn
2,4,5-TP*
Triademefon
Tricyclazole
Trifluralin*
Vernolate

* *Priority pesticides which have a high potential for leaching into groundwater. For information on Health Advisories, contact the Safe Drinking Water Hotline, 1-800-426-4791, toll-free Mon-Fri 8:30-4:30 E.S.T. (In Washington, D.C., call 382-5533).*

Appendix 2

Community Water System Sampling Schedule and Information

Alaska

CWS Name	City	Zip	Sampling Week
Tanana Village Safewater	Tanana	99777	06/05/89 - 06/09/89
Kalskag	Kalskag	99626	06/26/89 - 06/30/89

Idaho

CWS Name	City	Zip	Sampling Week
Honeysuckle Hill Water System	Hayden Lake	83835	09/19/88 - 09/23/88
Evergreen Mobile Park	Meridian	83642	11/14/88 - 11/18/88
Chaparral Water System	Eagle	83616	11/28/88 - 12/02/88
Emmett Water System	Emmett	83617	01/23/89 - 09/29/89
Riverview Villa	American Falls	83211	09/25/89 - 09/29/89

Oregon

CWS Name	City	Zip	Sampling Week
Highland View MHP	Oregon City	97045	09/12/88 - 09/16/88
Marcola Water District	Marcola	97454	10/17/88 - 10/21/88
Sky Crest Hts Prop Owners Assoc.	Grants Pass	97526	11/28/88 - 12/02/88
Keizer W.D.-Cedar Park W.S.	Salem	97303	03/13/89 - 03/17/89
Pioneer Mobile Home Park	Boring	97009	05/22/89 - 05/26/89
Blue Moon Trailer Park	Grants Pass	97526	06/05/89 - 06/09/89
Wolf Cr. Hwy. Water District	Beaverton	97075	10/16/89 - 10/20/89

Washington

CWS Name	City	Zip	Sampling Week
Detroit Water Service Assoc.	Grapeview	98546	09/05/88 - 09/09/88
Seven Lakes Water Assoc.	Lakewood	98259	09/19/88 - 09/23/88
Kennewick, City of	Kennewick	99336	09/26/88 - 09/30/88
Mobile Manor Tr. Park	Seattle	98114	10/17/88 - 10/21/88
Mesa Water Department	Mesa	99343	11/14/88 - 11/18/88
Granite Falls Water Dept.	Granite Falls	98252	02/06/89 - 02/10/89
Flowers Water Company	Oak Harbor	98277	02/13/89 - 02/17/89
Vancouver, City of	Vancouver	98668	02/20/89 - 02/24/89
Fircrest, Town of	Fircrest	98466	02/27/89 - 03/03/89
Consolidated Irri District #19	Green Acres	99016	03/20/89 - 03/24/89
Trails End	Bellevue	98005	05/01/89 - 05/05/89
Valley View Estates Water Assoc.	Sedro Wooley	98284	05/08/89 - 05/12/89
Fife Dept. of Public Works	Fife	98424	05/15/89 - 05/19/89
W & B Waterworks #1	Freeland	98249	08/21/89 - 08/25/89
Holiday Ranchettes	Olympia	98503	09/25/89 - 09/29/89

Appendix 3

National Bioaccumulation Study

List of Target Analytes

- Biphenyl
- Butachlor
- Chlorbenzilate
- Chlordane, cis
- Chlordane, trans
- Chlorinated Dioxins & Furans:
  - 2378-TCDD
  - 12378-PeDD
  - 123678-HxDD
  - 123789-HxDD
  - 123478-HxDD
  - 1234678-HpDD
  - 2378-TCDF
  - 12378-PeDF
  - 23478-PeDF
  - 123678-HxDF
  - 123789-HxDF
  - 123478-HxDF
  - 234678-HxDF
  - 1234678-HpDF
  - 1234789-HpDF
- Chlorpyrifos
- p,p' -DDE
- Dicofol (Kelthane)
- Dieldrin
- Diethylhexylphthalate (DEHP)
- Diphenyldisulfide
- Endrin
- Heptachlor
- Heptachlor epoxide
- Hexachlorobenzene (HCB)
- Hexachlorocyclohexanes (BHC) including Lindane
- 1,3,5-Trichlorobenzene
- Isopropalin
- Kepone
- Mercury
- Methoxychlor
- Mirex
- n-alkanes (C_{20-32})
- Nitrofen
- Nonachlor, cis
- Nonachlor, trans
- Octachlorostyrene
- Oxychlordane
- Pentachloroanisole
- Pentachlorobenzene
- Pentachloronitrobenzene (PCNB)
- Pentachlorophenol
- Perthane
- Polychlorinated Biphenyls:
  - Mono-Decachlorinated Biphenyls
- 3,4,3',4' -Tetrachlorobiphenyl
- 3,4,5,3',4' -Pentachlorobiphenyl
- 3,4,5,3',4',5' -Hexachlorobiphenyl
- Total PCBs
- 1,2,4,5-Tetrachlorobenzene
- 1,2,3,4-Tetrachlorobenzene
- 1,2,3,5-Tetrachlorobenzene
- 1,2,3-Trichlorobenzene
- 1,2,4-Trichlorobenzene
- Trichloronate
- Trifluralin
- Triphenyl phosphate

Appendix 4

Priority Setting
Idaho Department of Agriculture
1987 (10/86 - 9/87)

Types of Applicator (Total Count)

Applicator Type	**Count**	**Percent**
Aerial	21	35.6
Commercial/Urban Sprayer	12	20.3
County*	7	11.9
Farmer**	6	10.2
Unknown (disposal cases)	5	8.5
Other	3	5.1
City***	2	3.4
Homeowner	2	3.4
Ag Gnd (commercial)	1	3.4
Total	**59**	**100.0**

1987
Percent of Harm (by Applicator Type)

Applicator Type	**Count**	**Total Harm**	**Percent**
Commercial/Urban Sprayer	14	61.0	33.5
Aerial	21	47.0	25.8
County*	7	30.0	16.5
Farmer**	6	16.0	8.8
Unknown	5	10.0	5.5
Homeowner	2	7.0	3.9
Other	3	5.0	2.8
City***	2	4.0	2.2
Ag Gnd (commercial)	1	2.0	1.1
Total	**61**	**182.0**	**100.0**

* This includes county weed, county highway and local highway districts doing rural right-of-way spraying.
** This includes one case of chemigation for total harm of four points or 2.2% of total harm.
*** This includes governmental agencies doing pest control within city limits, i.e., parks departments.

Appendix 4 (continued)

1987
Percent of Harm (by Chemical)

Chemical	**Count**	**Total Harm**	**Percent**
Phenoxy*	20	36.0	19.8
Oust	5	26.0	14.3
Chlordane	4	25.0	13.7
Empty Containers	7	14.0	7.7
Dinoseb	2	14.0	7.7
Pramitol	2	10.0	5.5
Diquat	6	9.0	5.0
Phorate	1	5.0	2.8
Dursban TC	2	4.0	2.2
Furadan	1	4.0	2.2
Monitor	2	4.0	2.2
Sevin	2	4.0	2.2
Mocap	2	4.0	2.2
Diazinon	2	3.0	1.6
Prentox	1	2.0	1.1
Rodenticide	1	2.0	1.1
Roundup	1	2.0	1.1
Malathion	1	2.0	1.1
Sulfur	1	2.0	1.1
2,4,5-T	1	2.0	1.1
Paraquat	1	2.0	1.1
Tordon	1	2.0	1.1
Lindane	1	2.0	1.1
Various	1	1.0	0.6
Bayleton	1	1.0	0.6
Acrolein	1	0.0	0.0
Phostoxin	1	0.0	0.0
Total	**71**	**182.0**	**100.0**

* Phenoxy includes 2,4-D, MCPA, Banvel, etc; does not include 2,4,5-T or Silvex.

Appendix 4 (continued)

1987
Percent of Harm (by Application Site)

Application Site	Count	Total Harm	Percent
Disposal	11	38.0	20.0
Right-of Way	7	30.0	16.5
Yard & Garden	12	26.0	14.2
Grain	10	20.0	11.0
Bldg Interiors	2	12.0	6.6
Home	5	10.0	5.5
Potatoes	6	10.0	5.5
Peas	2	6.0	3.3
Storage	1	5.0	2.8
Alfalfa Seed	3	4.0	2.2
Hay	1	4.0	2.2
Noncrop	2	4.0	2.2
Rangeland	2	4.0	2.2
Fish Pond	1	3.0	1.6
Golf Course	1	2.0	1.1
Mint	1	2.0	1.1
Beets	1	1.0	0.6
Various	1	1.0	0.6
Ditch Water	1	0.0	0.0
Gophers	1	0.0	0.0
Total	**71**	**182.0**	**100.0**

1987
Percent of Harm (by Damage Site)

Damage Site	Count	Total Harm	Percent
Beets	15	44.0	24.2
Disposal	11	38.0	20.9
Yard & Garden	10	21.0	11.5
Human	9	21.0	11.5
Unregistered Use	10	19.0	10.4
Livestock	2	7.0	3.9
Hay	4	7.0	3.9
Peas	2	7.0	3.8
Grain	2	6.0	3.3
Contaminant	2	4.0	2.2
Potatoes	2	4.0	2.2
Fish	1	3.0	1.6
Corn	1	1.0	0.6
Total	**71**	**182.0**	**100.0**

Appendix 4 (continued)

1987
Percent of Harm (by Cause)

Cause	No. of Incidents	Total Harm	% Total Harm
Drift/Movement	27	71	44
Misapplication	21	54	34
Disposal	10	29	18
Storage	1	5	3
Applicator Exposure	1	1	1
Worker Exposure*	1	1	1
Total	**61**	**161**	**101**

* Other than applicator

Appendix 5

Priority Setting for FY88
(10/87 through 09/88)
EPA Enforcement Grant

The enforcement priorities of the Washington State Department of Agriculture, Agricultural Chemical Branch are as follows:

1. groundwater contamination;
2. agricultural aerial phenoxy herbicide drift/misuse;
3. agricultural ground herbicide drift/misuse (include right-of-way and roadside use);
4. agricultural aerial desiccant/defoliant drift/misuse;
5. agricultural aerial insecticide drift/misuse;
6. PCO misuse cases (includes both structural and other in-structure pest control);
7. agricultural ground insecticide drift/misuse;
8. ornamental/residential pesticide drift/misuse;
9. aerial/ground forest environment misuse;
10. farmworker exposure;
11. cancellation compliance inspection;
12. aquatic use/misuse;
13. product problems (misbranding, bulking out, non-registration, sale of restricted use products to non-certified person, etc.);
14. storage/transportation/disposal problems;
15. pesticide use problems associated with major spray programs.

Historical data for the last eight grant periods was analyzed. The Master List of Investigations, (a historical record of all cases investigated by the Agricultural Chemical Branch for the designated time periods) was used.

The Master list of Investigations was initiated in 1975 as a tracking system of cases in progress and a guide to historical case investigation files. All cases are logged as they come to the notice of the Agicultural Chemical Branch, at the time of initial complaint, referral, or discovery of a possible violation during routine sampling or surveillance work. (Routine surveillance activity -- monitoring, patrol work, marketplace sampling, Producer Establishment Inspections, etc.-- is not logged on the Master List unless a possible violation of law is discovered.) A sequential number is assigned each case. The nature of the case, including whether the primary concern of the investigation is a violation of law or verification of pesticide damage, the name of the investigator, the investigator's conclusions, and the final disposition of the case are recorded in chart form. Approximately 400-500 cases per year are investigated by the Agricultural Chemical Branch. For this document, the contents of the Master list for FY80, FY81, FY82, FY83, FY84, FY85, FY86, and partial FY87 (through April 87) were examined, a total of 2127 cases. Each case was allotted to one of thirteen categories on the basis of its **primary** concern. "Agricultural" in this context includes roadside and right-of-way incidents. Please note no attempt was made to separate out verified damage or proven violation cases from unproven or disproven allegations.

As you can see, the numbers in this data generally (but not always) support the priorities established above.

Appendix 5 (continued)

Master List of Investigations

	10/79-09/80	10/80-09/81	10/81-09/82	10/82-09/83	10/83-09/84	10/84-09/85	10/85-09/86	10/86-09/87	Total
Agricultural aerial phenoxy drift/misuse	77	63	71	34	25	43	70	14	397
Agricultural aerial desiccant/defoliant drift/misuse	19	15	11	5	15	15	20	1	101
Other agricultural aerial herbicides	--	--	--	--	--	18	7	5	30
Agricultural aerial insecticide drift/misuse (including most bee kills)	35	33	27	40	44	29	56	0	264
Agricultural ground herbicide drift/misuse	32	39	38	33	29	81	84	16	352
Agricultural ground insecticide drift/misuse	20	18	22	19	31	27	36	8	181
Ornamental/residential drift/misuse	37	28	34	27	26	45	56	17	270
Aerial/ground forestry misuse	14	2	7	3	5	6	1	1	39
PCO misuse	27	17	20	25	16	46	46	14	211
Farmworker exposure	7	7	6	2	5	5	5	0	37
Aquatic use/misuse	5	3	2	7	9	4	5	3	38
Sales of restricted-use products to uncertified applicators	--	--	--	6	2	13	14	21	56
Storage/transportation/Disposal	20	25	14	14	14	28	28	8	151
Year Totals	**293**	**250**	**252**	**215**	**221**	**360**	**428**	**108**	**2127**

Appendix 5 (continued)

With the advent of recently developed non-phenoxy herbicides in the traditional phenoxy use patterns, significant numbers of cases involving these non-phenoxy herbicides have occured. For this reason, we have begun to include non-phenoxy herbicides in this data evaluation.

The Master List data was also recast into EPA's arbitrary format for use-related cases as follows:

	10/81-09/82	10/82-09/83	10/83-09/84	10/84-09/85	10/85 09/86
Home/yard incidents					
-involving PCO's*	20	25	27	66	65
-involving homeowner use	17	14	21	25	37
Other urban incidents	20	17	16	15	20
Agricultural incidents					
-aerial	122	88	119	105	153
-ground	56	50	57	58	90
-not involving application		data not available			
Non-urban, right-of-way					
-aerial	0	0	0	0	0
-ground	22	21	19	51	22
Woodland incidents	7	3	5	6	1
Other sites	9	14	13	8	11

* In Washington State terminology, PCO refers to people working within structures (the termite-cockroach-rat control business). For purposes of this data only, we have included the commerical ornamental applicators (the "backyard sprayers") as PCO's since this seems to be the federal definition.

Product/facility-related priorities data from the Master List and other enforcement files:

	10/81-9/82	10/82-9/83	10/83-9/84	10/84-9/85	10/85-9/86
Violative firms within the state	4	5	5	3	5
Violative firms within the region but not in state	0	0	0	1	0
Violative firms outside region	0	2	1	0	1

Appendix 5 (continued)

Priorities were set on further considerations:

1. WSDA has done some investigational work involving groundwater contamination problems with picloram and EDB in the past. New findings of contamination with other compounds in groundwater are making more groundwater investigation and closer coordination with the WSDOE and DSHS water people necessary. We anticipate more activity in this area and have made groundwater contamination our top priority again for FY88.

2. Eastern Washington state supports approximately 3,000,000 acres of small grain, chiefly wheat, and approximately 26,000 acres of wine and juice grape vineyards. These two crops are often in close proximity. Much of this small grain is treated with phenoxy herbicides, an average of once per growing season, usually with aerial apparatus. Grapes, on the other hand, are extremely sensitive to phenoxy injury at remarkably low dosages. Large amounts of phenoxy herbicides applied within a short period of time have caused widespread air contamination problems, causing damage in virtually every vineyard in eastern Washington (at one time or another), which cannot be traced to conventional drift situations. It has been shown that, depending on weather conditions, phenoxy herbicides applied according to label directions can be found up to 30 miles from the target site. In addition, conventional drift situations also account for high monetary damage to susceptible crops. The WSDA has been working with the affected industries for many years to minimize damages to an acceptable level by regulation and by encouraging technological developments to minimize all types of drift. In 1983, 1984, and 1985 crop seasons showed a notable decrease in the number of agricultural phenoxy cases and complaints, particularly with aerial equipment. This is due to favorable weather conditions, development of newer non-phenoxy herbicides, and regulatory action. The 1986 season showed a sharp upsurge in phenoxy damage. Weather conditions in fall, 1985 were unfavorable to use of winter-applied herbicides (such as Glean) in eastern Washington wheatlands. Because of this, spring-applied phenoxy use increased greatly for the 1986 season. Since spring is a very vulnerable time for phenoxy damage on other crops, the increased phenoxy use led to increased phenoxy damage cases. The department feels this may be a temporary phenomenon and that (if the weather cooperates) phenoxy cases may decrease in FY88. However, due to these numbers agricultural aerial phenoxy herbicides drift/misuse has been moved to #2 priority.

3. Agricultural aerial desiccant/defoliant drift/misuse was WSDA's #2 priority in FY1983. Industry practices dictated intense aerial applications of desiccants and defoliants (mostly dinoseb and paraquat) in areas in and around Walla Walla county on approximately 15,000 acres of alfalfa seed fields in September. Portions of this alfalfa seed-growing area overlook or are in proximity to the spinach crop grown in the Walla Walla Valley. Some of this spinach is grown for fresh market. It is an extremely high cash-value crop and must be flawless. (Desiccant/defoliant damage is expressed as necrotic spots on the leaves.) The rest of the approximately 200 acres of spinach is processed and must be relatively free of desiccant/defoliant damage. An air contamination problem similar to the phenoxy situation was documented, particularly in 1980, in the spinach acreage. A decline in aerial desiccant/defoliant cases occurred in FY82 and FY83. For this reason, we eliminated this as a separate priority category in FY83.

   The suspension of dinoseb changed this picture for 1987 and 1988. The required grower education effort, monitoring, and field enforcement for temporarily reinstated dinoseb uses on some crops made heavy demands on all personnel during spring 1987, which are not fully reflected by Master List numbers, as routine monitoring is not logged on the Master List. In addition, grower experimentation with unfamiliar materials used as dinoseb substitutes, particularly in the Walla Walla seed alfalfa and Basin potato areas, in FY88 will result in greatly increased numbers of cases in the categories agricultural ground herbicide drift/misuse and agricultural aerial desiccant/defoliant drift/misuse. We have reinstated agricultural aerial desiccant/defoliant drift/misuse as #4 priority in FY88.

4. Bee kills are of great economic and environmental importance to the state. For this reason, agricultural aerial insecticide work (the source of many, but not all, bee kills) has been given a very high priority.

5. Ornamental/residential drift/misuse cases include both commercial applications and applications by unskilled property owners. Materials available for ornamental/residential property applications are generally limited to the less toxic and/or more dilute products considered suitable for registration on these sites. Numbers of this category of cases and enforcement actions decreased in FY83, and remained stable in FY84 and FY85. They increased dramatically in FY86 and FY87, but remain midway on the priority list, since as a whole they have less potential for

Appendix 5 (continued)

great negative economic or environmental impact.

6. The forest products industry has economic problems which have forced dramatic cutbacks in expenses such as herbicide applications in recent years. This is regarded as a temporary situation. However, until this turns around, priority of this type of case will remain low.

7. By statute, WSDA shares the responsibility for investigation of pesticide-related human health incidents with the Health Services Division of the Washington Department of Social & Health Services, which employs an independent staff for this. Farmworker exposure cases are investigated by both agencies working in coordination. As in all cases involving alleged human exposure or poisoning, individual incidents often become immediate investigational priorities, despite the relative infrequence of this type of case.

8. Use/follow-up investigation work is often seasonal, at least in the agricultural areas. The majority of pesticide product investigations are conducted during the off season, hence their low overall priority. In addition, Washington has comparatively few producer establishments, and those are usually not manufacturing facilities, but repackagers or custom blend fertilizer operations. The potential for major problems in product/facility-related areas is relatively minor in this state.

9. Storage problems tend to surface during the course of routine surveillance activities, and their numbers are directly proportional to the staffing level of investigators. Many of these cases are handled in the off season, accounting for their low overall priority. Transportation and disposal problems tend to occur in the use season, but are not numerically significant. Individual incidents, of course, may take priority. Statutory responsibility for handling spills and immediate disposal problems is shared with the Washington Department of Ecology, with whom we cooperate.

Actions anticipated to alleviate priority problems:

1. We will not be able to evaluate potential preventative action in the groundwater contamination area until we build an information base. FY87 began this information generation, and FY88 will continue it.

2. Agricultural aerial phenoxy damage was long stated as Washington State's primary overall priority. A network of regulations setting forth nozzle and swirl plate size restrictions, cutoff dates for both aerial and ground applications of different chemical forms of the various phenoxys, spray boom lengths, nozzle angles, etc., for defined areas within each affected county was implemented many years ago and is refined often. The regulations continue to be refined, and significant resources will continue to be devoted to patrol and surveillance activities, including aerial surveillance, and to regulatory action on violation of these regulations. All investigable complaints are investigated. Although variations in damage due to environmental conditions (climate, volcano eruptions, grape varietal susceptibility) make year-to-year numerical assessment of the effectiveness of this program impossible, it appears that it has been worthwhile, as the grape acreage and the value of the grape crop in this state has increased steadily, indicating the grape-growing industry feels relatively secure from potentially crippling crop damage.

3. A similar regulation governing desiccant/defoliant applications in Walla Walla County was implemented in early 1981 and modified in early 1985. Similar routine enforcement activity was intitiated. Damage appeared to have decreased, and the number of complaint cases investigated dropped dramatically. With removal of the most familiar material (dinoseb), we anticipate several seasons of turmoil and regulation revision before the situation again stabilizes.

4. Every year there is continuing effort to refine existing regulations governing insecticide use in potentially bee-attractive crops to alleviate damage.

5. Ground herbicide drift/misuse is subject to surveillance at the same time as aerial phenoxy activity and is generally treated similarly. We anticipate the increases in recent years in this type of case will continue, as dinoseb/substitutes applied with ground equipment will cause increased cases, even if (as anticipated) ground phenoxy cases decrease.

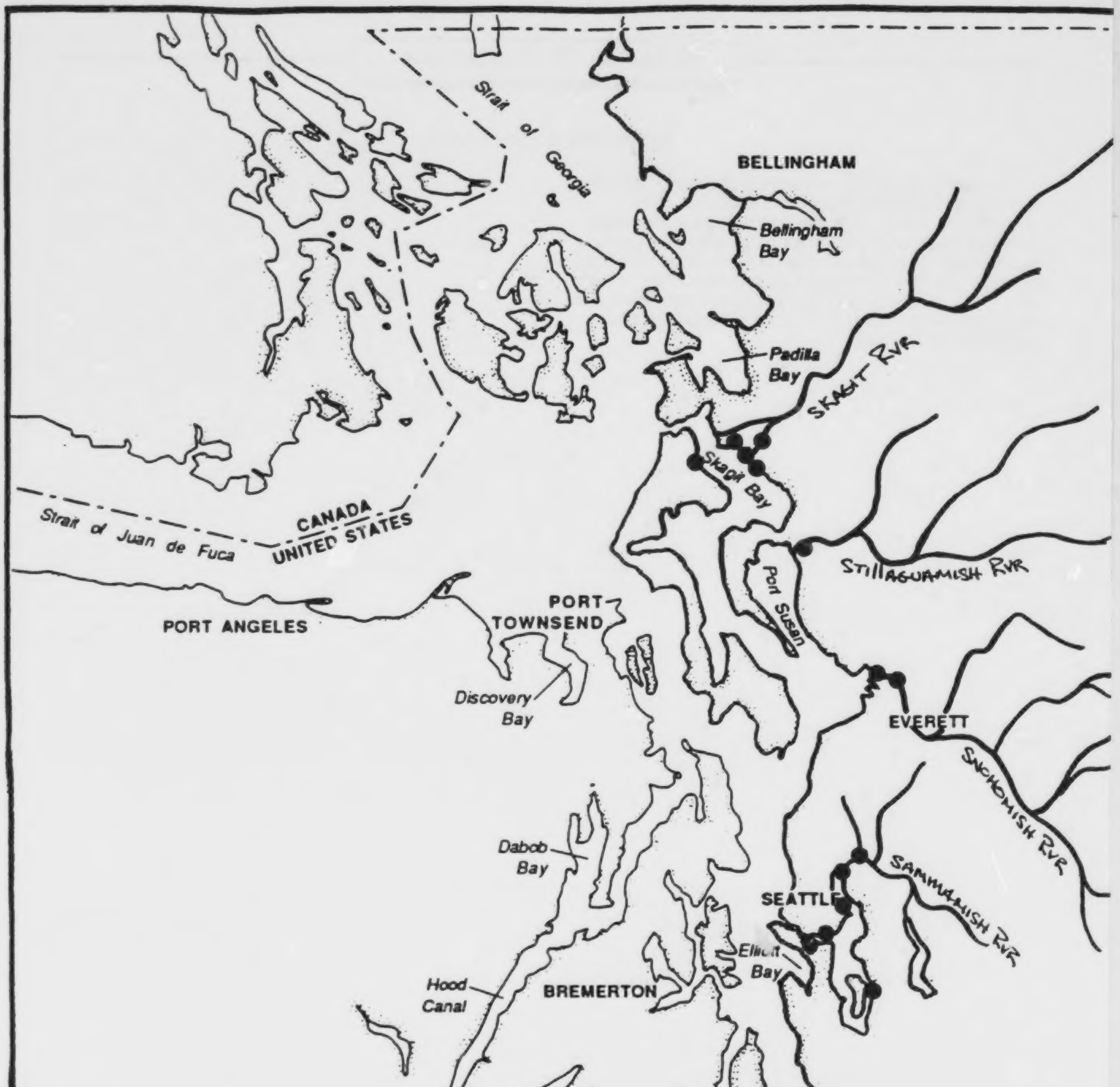
6. Lower priority category regulatory activity is generally limited to response to complaints concerning ornamental/residential drift/misuse, forestry misuse, aquatic use/misuse, farmworker exposure, cancellation compliance inspection, and surveillance of major spray programs.

7. Routine surveillance in the off season and complaint response are utilized for product problems and storage/transportation/disposal problems.

Appendix 5 (continued)

In grant year FY83, we were faced with declining funding and resulting manpower problems. We responded to all complaints, and resource allocation followed these priorities as much as possible, under increasingly adverse conditions. Conditions improved during FY84 and remained stable during FY85, FY86, and FY87, and, if current funding levels do not decline, we anticipate an acceptable level of response and enforcement in FY88.

Pesticides of Concern in Puget Sound - 1988 Sampling Sites Appendix 6


Strait of Georgia
BELLINGHAM
Bellingham Bay
Padilla Bay
SKAGIT RVR
Skagit Bay
CANADA
UNITED STATES
Strait of Juan de Fuca
PORT ANGELES
PORT TOWNSEND
Discovery Bay
Port Susan
STILLAGUAMISH RVR
EVERETT
SNOHOMISH RVR
Dabob Bay
SEATTLE
SAMMAMISH RVR
Elliott Bay
Hood Canal
BREMERTON
Commencement Bay
TACOMA
0 10 20
miles
kilometers
0 20 40
OLYMPIA
NISQUALLY RVR

Appendix 7

Puget Sound Pesticides of Concern Targeted for Analysis in Work Assignment 1-113

Triazine compounds

prometon, **simazine**[a,b] **atrazine**[a]

Organophosphorus compounds

chlorpyrifos[b], glyphosate, **phorate**[b] **disulfuton**[a]
diazinon[a], **(ethyl) parathion**[b], **methyl parathion**[b]

Carbamate compounds

vernolate[a], **butylate**[a]

Organochlorine compounds

chlordane[b], **lindane**[c], **pentachlorophenol**[c]

Miscellaneous

trifluralin[b,c] **pronamide**[a], dichlorbenil, **fenvalerate**[c]

Primary analytes are **printed in bold face**.
a: Gas chromatographic conditions established, EPA (1987)
b: Suitability for gel permeation chromatographic cleanup determined, AOAC (1980)
c: Gas chromatographic conditions established, EPA SW-846 (1986)

RCRA Environmental Indicators
FY 88

1. **Groundwater quality at RCRA regulated land disposal facilities** *(Regulated Units and Solid Waste Management Units)*

2. **Groundwater/soil quality at RCRA regulated incineration, storage and treatment facilities** *(Regulated Units and Solid Waste Management Units)*

1. Groundwater Quality at RCRA Regulated Land Disposal Facilities
(Regulated Units and Solid Waste Management Units)

Description

The RCRA environmental indicator is intended to convey information about the progress the region is making towards protecting ground water quality at RCRA regulated land disposal facilities (LDFs)--both at regulated units and at solid waste management units (SWMUs).

Under the RCRA program, a facility is defined as all contiguous property under the control of an owner or operator at which the units subject to permitting (also known as regulated units) are located. Regulated units subject to groundwater monitoring at LDFs include surface impoundments, landfills, land treatment units, and some waste piles. These units currently receive regulated hazardous wastes or have ceased receiving regulated hazardous wastes, and these regulated units are subject to the interim status or permit performance and operating standards under Parts 265 and 264, respectively.

At RCRA regulated facilities (those subject to interim status or permitting requirements), there may be solid waste management units (SWMUs), which EPA has the authority to address. SWMUs are defined as any discernible waste management unit from which hazardous constituents may migrate, irrespective of whether the unit was intended for the management of solid or hazardous wastes. The following types of units are therefore included in the definition of SWMUs: landfills, surface impoundments, waste piles, land treatment units, incinerators, injection wells, tanks, container storage tanks and transfer tanks.

In addition to these types of units, certain areas associated with production processes at facilities which have been contaminated as a result of routine, systematic and deliberate releases of wastes, or hazardous constituents are also considered SWMUs. SWMUs that are releasing hazardous waste or constituents into the groundwater are subject to the corrective action requirements under Section 3004(u) or 3008(h) of the Hazardous and Solid Waste Amendment (HSWA). Corrective action measure requirements compel the facility to conduct remedial actions necessary to protect human health or the environment, based on any information that there is or has been a release of hazardous waste or constituents from a RCRA facility. EPA oversees this process. It is important to note that jurisdiction for corrective action activities is limited to facilities which are subject to interim status or permitting requirements (i.e., this restriction would not generally allow EPA to address past practices at generator sites).

Groundwater contamination could result from a regulated unit (i.e., land disposal unit or hazardous waste surface impoundment) or from a SWMU. Progress in decreasing groundwater contamination is measured by counting specific actions or "steps" associated with groundwater protection (detection and remediation) that have been initiated or completed at LDFs. Specifically, the indicator uses the following parameters to measure progress in protecting groundwater at LDFs.

A. Detection Steps

1. The number of **LDFs** with **interim status** groundwater monitoring **systems initiated** pursuant to 40 CFR Part 265

2. The number of **LDFs** with **interim status** groundwater monitoring **systems established** pursuant to 40 CFR Part 265

3. The number of **LDFs** for which the **aquifer** is **characterized** in order to establish an appropriate groundwater monitoring system pursuant to Parts 264 and 270

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4. The number of **LDFs** with **final** groundwater monitoring **systems established** pursuant to 40 CFR Parts 264 and 270

5. The number of **LDFs** with **known** groundwater **contamination** due to releases from regulated units and/or SWMUs

B. Remediation Steps

6. The number of **LDFs** with known groundwater contamination due to releases from regulated units and/or SWMUs for which **remedial actions** have been **initiated**

7. The number of **LDFs** with remedial actions underway for which groundwater **contamination** has been **stabilized** and/or **reduced**

8. The number of **LDFs** with **remedial actions completed**

Steps 1 through 4 only pertain to regulated units. Steps 5 through 8 pertain to both regulated units and SWMUs. Appendix A provides further clarification of the above parameters.

Limitations

This indicator conveys general information about progress in detecting and remedying releases to groundwater (the primary environmental pathway for releases of hazardous constituents from RCRA regulated LDFs) from land disposal waste management units such as landfills, land treatment units, surface impoundments and some waste piles and from SWMUs located at land disposal facilities. This indicator does not cover detecting and remedying releases to groundwater from SWMUs located at non-land based waste management sites (TSFs) such as tanks, containers, incinerators, or other storage and treatment facilities which are not land disposal facilities. Land based units are units where wastes are placed on or into the ground. These SWMUs however, are also a source of groundwater contamination and are subject to groundwater remediation.

This indicator does not differentiate between interim and final remedial actions. If interim remedial actions are counted, then the steps under remediation may have several dates. For example, an interim remedial action may be initiated, with the result of the contamination being reduced and the action complete. Then another interim or final remedial action may be undertaken by the same facility.

Furthermore, this environmental indicator does not convey specific information about groundwater quality and corrective action measures that would allow conclusions to be made about the state of the environment. For example, the indicator does not convey information about the extent and degree of groundwater contamination nor does it convey information about the risks to human health and the environment from such contamination.

Finally, the indicator does not convey information about the extent to which groundwater quality has been improved as a result of corrective action measures and other remedial actions.

Results

Figures 11.1, 11.2 and 11.3 illustrate the detection and remediation steps for this environmental indicator on groundwater quality at RCRA regulated land disposal facilities.

FY88 shows a dramatic increase for all of the detection steps and the remedial steps (with respect to remedial actions initiated). Groundwater aquifer characterized and final groundwater monitoring established shows over twice as much activity accomplished in FY88 than in FY87. During FY89, we expect to see greater activity levels in remediation -- remedial actions underway for which groundwater contamination has been reduced and/ or stabilized and remedial actions completed (especially in terms of interim remedial actions). To summarize, the region has made great progress towards protecting groundwater quality at RCRA regulated land disposal facilities during FY88.

Figure 11.1

ESTABLISHMENT OF GW MONITORING NETWORKS

AT 48 RCRA LAND DISPOSAL FACILITIES

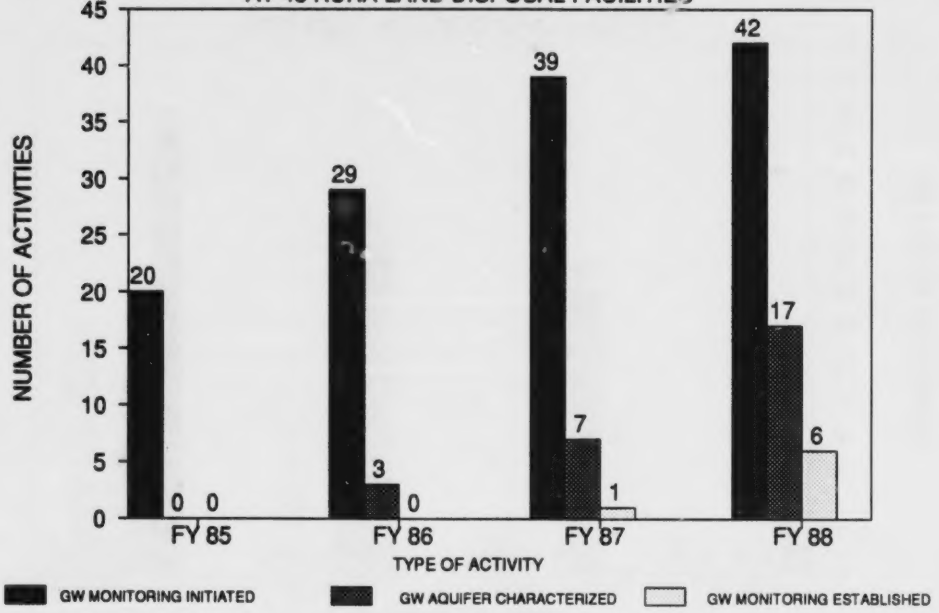


Figure 11.2

TSF FACILITIES (REGULATED UNITS AND SWMUs)

GROUNDWATER QUALITY

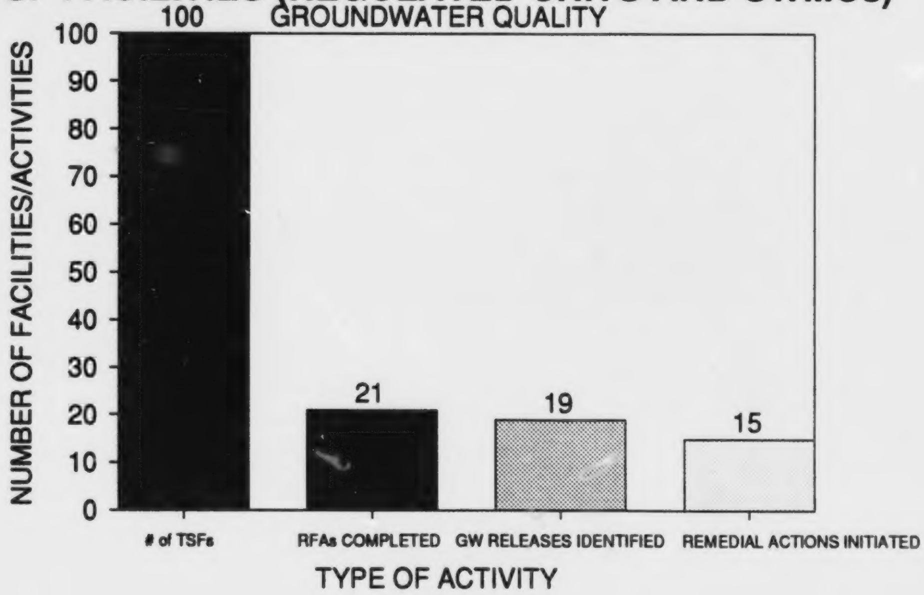
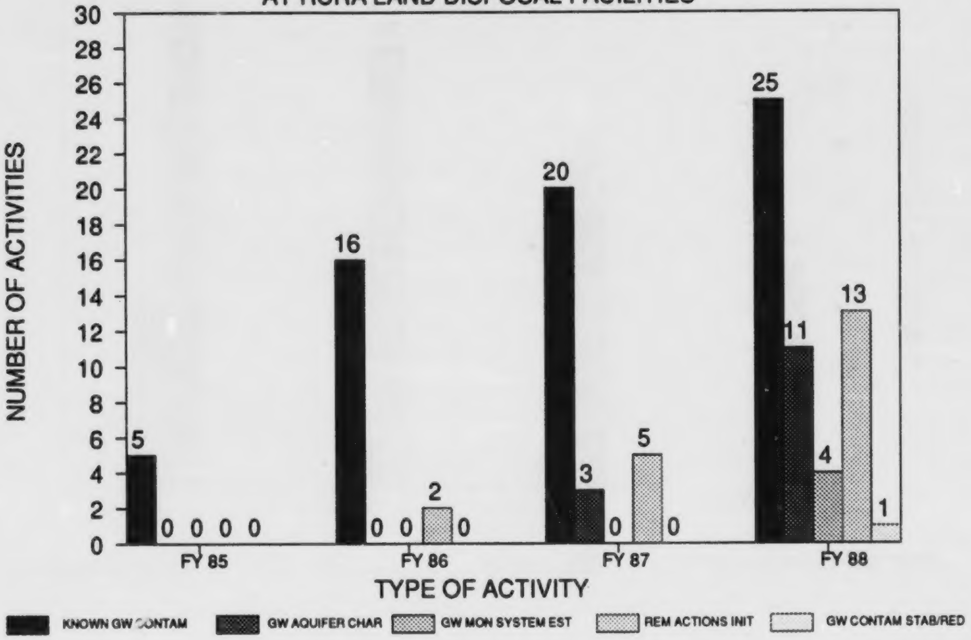


Figure 11.3

REMEDIAL ACTIVITIES FOR KNOWN GW CONTAMINATION

AT RCRA LAND DISPOSAL FACILITIES



2. Ground Water/Soil Quality at RCRA Regulated Incineration, Storage and Treatment Facilities (Regulated Units and SWMUs)

Description

This indicator is intended to convey information about the progress the region is making towards protecting groundwater quality and soil quality at RCRA regulated treatment and storage facilities (TSFs) other than land disposal facilities (LDFs) -- both regulated and SWMUs.

The RCRA program regulates non-land based waste management units, such as tanks, containers, incinerators, treatment and storage facilities, also known as TSFs. These units, which currently receive regulated hazardous wastes or have ceased receiving regulated hazardous wastes, are subject to the interim status or permit standards under Parts 265 and 264 respectively. Since the regulated units are not land-based, groundwater monitoring is generally not required.

As with land disposal facilities, the two types of units located at TSFs are regulated units and SWMUs. SWMUs that are releasing hazardous waste or constituents into the groundwater are subject to the corrective action requirements under Section 3004(u) or 3008(h) of HSWA and may require groundwater monitoring and remediation. The only situation where a regulated TSF unit would be subject to regulated unit groundwater monitoring requirements would be unauthorized discharge of the regulated hazardous waste into the ground. As a result, most of the remedial activities which pertain to protection of groundwater will occur at SWMUs.

Progress is measured by counting specific actions or "steps" associated with groundwater/soil protection (detection and remediation) that have been initiated or completed at TSFs, other than LDFs. Specifically, the indicator uses the following parameters to measure progress in protecting groundwater and soils at these types of facilities.

A. Detection Steps

1. The number of TSFs with assessments completed to determine existence of potential releases
2. The number of TSFs with releases identified

B. Remediation Steps

3. The number of TSFs for which remedial actions have been initiated
4. The number of TSFs for which releases have been characterized in order to implement comprehensive remedial action measures
5. The number of TSFs with remedial actions underway for which groundwater/soil contamination has been stabilized and/or reduced
6. The number of TSFs with remedial actions completed

Limitations

This indicator conveys general information about progress in detecting and remedying releases to groundwater. Therefore, this indicator would provide useful information only with respect to those TSFs with unauthorized discharges into the ground or with respect to SWMUs, located at TSFs, which have been a source of groundwater contamination, therefore subject to remediation.

We were unable to determine a way to readily obtain information to determine the extent of soil contamination at TSFs or measure our progress in reducing soils contamination at the TSFs. As a result, we have no data for soil quality at TSFs for FY88.

This indicator does not differentiate between interim and final remedial actions. If interim remedial actions are counted, then the steps under remediation may have several dates. For example, an interim remedial action may be initiated, with the result of the contamination being reduced and the action complete. Then another interim or final remedial action may be undertaken by the same facility.

This indicator requires much of the same type of information as the environmental indicator on groundwater quality at RCRA regulated land disposal facilities and tracks much of the same type of information. Thus the differentiation between land disposal facilities and other types of TSFs such as incineration, storage and treatment facilities is largely an artificial one with respect to groundwater remediation.

As noted under the limitations for the environmental indicator on groundwater quality at RCRA regulated LDFs, this indicator does not convey specific information about groundwater quality that would allow conclusions to be made about the state of the environment. For example, the indicator does not convey information about the extent and degree of groundwater contamination nor does it convey information about the risks to human health and the environment from such contamination. Finally, the indicator does not convey information about the extent to which groundwater quality has been improved as a result of remedial actions completed.

Results

FY88 shows very little activity for the detection steps and for the remedial steps (data is available upon request). During FY 88, we emphasized detecting and remedying groundwater contamination at land disposal facilities with respect to both RCRA permitting and compliance activities. It is unlikely that we will be dramatically increasing our groundwater detection or remediation with respect to TSFs, as groundwater quality is usually not a major environmental problem at TSFs.

As noted above, we were unable to obtain the information to measure our progress in reducing soils contamination at the TSFs. Therefore, we have no data for soil quality at TSFs for FY88. During FY89, we will explore the feasibility of tracking soil contamination remedial actions at TSF and LDF facilities.

Future Directions

During FY 87, we revised certain aspects of the indicator titled "groundwater quality at RCRA regulated land disposal facilities" to more accurately convey information about regional progress in protecting groundwater quality, such as broadening the universe to include SWMUs. In early FY 88, we added two additional steps under remediation of groundwater contamination for LDFs:

- Remedial actions underway for which groundwater contamination has been stabilized and/or reduced;
- Remedial actions completed.

In early FY88, we also added an environmental indicator which focused on TSFs other than LDFs (regulated incineration, storage and treatment facilities) and SWMUs located on the TSF sites. This indicator required much of the same type of information as the environmental indicator on groundwater quality at RCRA regulated land disposal facilities. Specifically, this new environmental indicator tracked the progress on detection and remediation of groundwater contamination resulting from improper waste management practices which is occurring or has occurred at these facilities in the past.

For FY89 and beyond, we recommend that these two environmental indicators be combined into one indicator. Essentially both of these measures track the same type of information. The differentiation between land disposal facilities and TSFs with respect to groundwater contamination remediation is largely an artificial one.

During FY89, we propose to explore the feasibility of tracking soil contamination remedial activities at both TSFs and LDFs. Specifically, we will investigate whether the necessary information can be readily obtained.

Additionally both of the current RCRA measures focus on the "clean-up" portion of the program. An environmental indicator needs to be developed which conveys the preventive nature of the RCRA program. Possible areas to measure environmental progress through use of environmental indicators could be:

- Impact of land ban on choice of hazardous waste disposal options; or
- Waste minimization/reduction/recycling activities.

These topics could be excellent areas to develop into a RCRA environmental indicator; however, determining how to develop such indicators and where to obtain the necessary data has been and will continue to be problematic and very time consuming. Appendix B provides a discussion of EPA HQ's (Office of Solid Waste) attempts to develop such environmental indicators.

We may be able to explore the use of some of the environmental indicator measures proposed by Office of Solid Waste, but we will need time to find the necessary data sources, analyze the potential effectiveness, predict the foreseeable problems in the collection of the data, and determine the workload/time requirements for implementation of such measures.

In order to develop a truly accurate environmental indicator which would convey the preventative nature of the RCRA program, we will need time to fully analyze the possible options. By the end of FY89, we will complete the analysis on the feasibility for developing an environmental indicator which would convey the preventative nature of the RCRA program.

Appendix A

1. Interim Status Groundwater Monitoring System Initiated

Indicates the facility has initiated the development and installation of a groundwater monitoring system required under 40 CFR Part 265 at the regulated unit(s) to determine the impact on the quality of groundwater beneath the facility.

2. Interim Status Groundwater Monitoring System Established

Indicates the facility has established an interim status groundwater monitoring program required under 40 CFR Part 265 at the regulated unit(s) to determine the impact on the quality of groundwater beneath the facility. An interim status groundwater monitoring program consists of the following components:

1. ***Development and installation of a monitoring system***
2. ***Background monitoring***
3. ***Routine monitoring and evaluation***
4. ***Conducting assessments***
5. ***Reporting requirements***

3. Aquifer Characterized

Indicates EPA/State has determined that the facility has satisfied the requirements under 40 CFR Parts 264 and 270 for the regulated unit(s) regarding protection of groundwater. This includes:

1. ***A summary of the groundwater monitoring data obtained during the interim status period under 40 CFR part 265;***

2. ***Identification of the hydrogeology beneath the facility, including groundwater flow direction and rate;***

3. ***A description of any plume of contamination, if any, that has entered the groundwater from the regulated unit;***

4. ***Identification of the concentration or maximum concentration of regulated hazardous constituents in the plume.***

4. Final Groundwater Monitoring System Established

Indicates EPA/State has determined that the facility has developed an adequate groundwater monitoring program necessary for conducting **detection monitoring** and **compliance monitoring**, or **corrective action** as required under 4O CFR part 264 at the regulated unit(s). Aspects of the groundwater monitoring program are specified in the RCRA permit issued to LDFs. An adequate program includes installation of an appropriate monitoring system and demonstration of proper techniques and procedures for sampling and analyzing monitoring results.

Detection monitoring is conducted to determine if hazardous wastes are leaking from the regulated unit. Detection activities are similar to those outlined under interim status. If leakage is detected, the facility must institute compliance monitoring and establish groundwater protection standards. **Compliance monitoring** is conducted to evaluate the concentration of certain hazardous constituents in the groundwater to determine if groundwater contamination is occurring. If compliance monitoring indicates any significant increase in the concentration of certain hazardous constituents, corrective action must be instituted. **Corrective action** is conducted to bring the facility contaminating groundwater into compliance. This can be achieved by removing hazardous waste constituents from the groundwater or treating the groundwater in place.

5. Known Groundwater Contamination from Regulated and/or Non-Regulated Units

Indicates the facilities where groundwater contamination due to releases from regulated and/or non-regulated units is known.

6. Remedial Action Measures Initiated

Indicates the facility has initiated remedial action measures to remove or treat in place releases of hazardous constituents to the groundwater from regulated or non-regulated units.

7. Groundwater Contamination Stabilized and/or Reduced

Indicates the facility has remedial action measures underway for which groundwater contamination has been stabilized and/or reduced from regulated or non-regulated units.

8. Remedial Actions Completed

Indicates land disposal facilities where remedial actions to remove or treat in place releases of hazardous constituents to the groundwater from regulated or non-regulated units, as required by EPA/State, have been completed.

Appendix B

Office of Solid Waste's Proposed Environmental Indicators

In FY 86, HQ's Office of Solid Waste (OSW) proposed several environmental indicators for the RCRA program, but were unable to implement them. For example, OSW proposed an indicator to measure progress on industry's waste reduction/ minimization. The problem with collecting data for such an indicator would be that measuring progress based on reduction of total amount of wastes generated over time may not accurately convey environmental progress because fluctuations of economic factors could greatly affect the data. A decline in consumer interest in the product may decrease production of the waste rather than the industry's use of waste reduction methods.

If Region 10 used an environmental indicator to measure industry's progress on waste reduction/ minimization, we would need to develop a way to control for industrial output. We may want to consider focusing on a specific industry which causes great environmental concern in the Region.

Another potential indicator proposed by OSW is measurement of waste treated or disposed of by "preferred" methods. This indicator could be used to demonstrate a decrease in reliance on land disposal of hazardous wastes. Whether data to support such a measure was easily obtainable became the major drawback. If we were to use such a measure, we would need to determine whether sufficient and applicable data would be available. We would also need to develop an official designation as to which methods would be considered "preferable."

RCRA Environmental Indicators FY 89 and Beyond

The following RCRA environmental indicator activities will be conducted in FY 89:

Cleaning Up Groundwater Contamination

Instead of dividing environmental indicators by Treatment and Storage Facilities (TSFs) universe and by Land Disposal Facilities (LDFs) universe, divide the universe into:

- ***those facilities with no groundwater contamination detected and on permitting track;***
- ***those facilities with groundwater contamination detected and on remedial action/closure track;***
- ***those facilities with groundwater contamination detected and on remedial action/permitting track;***
- ***those facilities where we have not determined whether groundwater contamination exists.***

Design appropriate milestones and graphs.

- Combine the TSF and LDF data where groundwater contamination has been detected into one environmental indicator which will be used to convey the progress on the remedial portion of the RCRA program. The steps under remedial activities should include a step on the physical initiation of remedial actions (i.e., the design of construction of a pump and treat system). Currently, the step labeled as "remedial action initiated" is an administrative definition whereby a permit condition or an enforcement order has been developed to require the facility to undertake remedial action.

- Using ambient pollution data, measure environmental improvement or progress as a result of remedial activities on a case-by-case basis. This may include such actions as amount of "dirt" moved, decrease in hazardous waste constituents in groundwater, etc. Since the implementation of remedial programs under RCRA is relatively recent, this environmental indicator may merely be providing baseline information during FY89 and FY90.

Prevention of Groundwater Contamination

- Develop an environmental indicator to measure RCRA's impact on preventing or decreasing groundwater contamination. Examples may include:

  - Graph the development of groundwater monitoring wells networks to assure that any contamination could be detected immediately (therefore, remedies could be implemented immediately to prevent the spread of the contamination). In recent permits issued, permittees are required to demonstrate effective performance of their groundwater monitoring wells network. During FY89 and FY90, we will collect baseline information of the demonstrations to use in the development of future environmental indicators.

  - Present case studies or success stories which clearly illustrate the effectiveness of the preventative side of the RCRA program. Examples may include RCRA permitted facilities where potential hazardous waste spills were contained due to implementation of RCRA requirements or older facilities which made major changes to their waste management practices.

  - Comparing older portions of RCRA facilities with the newer portions of the RCRA facilities to demonstrate the decreased risk of groundwater contamination on a case-by-case basis.

RCRA Environmental Indicators FY 89 and Beyond *(Continued)*

Waste Minimization/Source Reduction/Recycling

- Work with the Hazardous Waste Policy Branch to explore the development of an environmental indicator which measures environmental progress resulting from use of waste minimization/source reduction/recycling activities.

Potential activities may include:

- Determine HQ's progress towards developing national waste minimization/recycling/source reduction environmental indicators. Investigate the possibility of HQ funding Region 10 to be a pilot project.
- If data is available, demonstrate how the use of waste minimization/source reduction/recycling techniques results in environmental progress. Possible indicators using the biennial report and other readily available sources may include:

Graph the number of generators using waste minimization/source reduction/recycling techniques over the years (hopefully increasing over the years);

Determine a correlation between the types of production or service process which use waste minimization/source reduction/recycling most frequently and the effectiveness of these frequently used techniques;

Display the results of use of waste minimization/source reduction/recycling techniques in terms of changes on toxicity of hazardous waste generated, reduction in amount generated, etc.

- Present case studies which demonstrate environmental progress resulting from use of waste minimization/recycling/source reduction techniques.

Municipal Solid Waste

- Explore the development of an environmental indicator which can be used to measure environmental progress in the regional municipal solid waste program (i.e., recycling rate from major municipalities in the Northwest). Determine the types of data which will be needed to develop an effective environmental indicator for this new program and, if possible, assure that such data is collected as a routine portion of the municipal solid waste program.

Documentation of Success

- Compile a notebook of success stories in terms of innovative clean-up technologies, waste minimization/recycling/source reduction techniques by industries, municipalities, etc. located in Region 10. Distribute notebook widely in order to encourage other industries, municipalities, etc. to use these technologies or techniques (further description on distribution of the notebook can be found in the "Hazardous Waste Technology Transfer Risk Reduction Proposal").

Superfund Environmental Indicators
FY 88

SCAP/SPMS Measures

Region 10 Superfund Program Accomplishments as per Superfund Comprehensive Accomplishments Plan (SCAP) and Strategic Planning and Management System (SPMS) Commitments

Groundwater Cleanup

1. **Number of sites with contaminated aquifers**
2. **Number of sites under investigation**
3. **Number of sites with remediation in design or construction phase**
4. **Number of sites with ongoing 0&M**

Soils Cleanup

1. **Number of sites with contaminated soil**
2. **Number of sites under investigation**
3. **Number of sites with remediation in design or construction phase**
4. **Number of sites with remediation ongoing**
5. **Number of sites with remediation complete**

Surface Materials

1. **Number of sites where surface accumulation of materials represents public health or environmental exposure problem**
2. **Number of sites where remediation stabilized or eliminated threats of exposure to the public or the environment**

Description

Traditionally the Superfund Program had relied on the SCAP/SPMS measures to monitor performance at Superfund sites. These measures primarily focus on the phases of investigations and cleanup. Hence they are activity-oriented and do not specifically aim to measure changes in environmental or public health conditions.

In addition to the usual (SCAP/SPMS) milestones that measure progress through the Superfund process, this year we added three new categories to the Superfund "Environmental Indicators": Groundwater Cleanup, Soils Cleanup, and Surface Materials Cleanup. These categories place the major activity milestones such as Remedial Investigation/ Feasibility Study (RI/FS), removal actions and/or remedial actions within a context that we hope will reveal to some extent the problems that the activity(ies) plans to alleviate.

Limitations

Although this context somewhat captures the problem areas the Superfund Program intends to address or has addressed through its process, these "Environmental Indicators" do not reveal whether environmental improvements are being achieved, nor do they reveal the degree of success in improvements to the environment or public health. When reviewing these indicators, it is important to keep in mind the nature of the Superfund process and the long time frames involved. Over a thousand sites in this region have been identified as having potential problems. Of those, 55 have been put on the National Priorities List (NPL) and about a dozen have been handled as emergency removals. The first step for an NPL site in the Superfund process is the RI/FS, which typically begins one to two years after a site is listed on the NPL. This results in an understanding of the nature and extent of contamination and a proposal about how to clean it up. This is often followed by years of remedial action, if necessary, to deal with the problems found. Removals may be done at either NPL or non-NPL sites to deal with emergencies or health threats, but are often not the end of our response.

Hence, the current indicators should be interpreted conservatively as they are not specifically designed to measure the actual environmental improvement being achieved by the Superfund process.

Results

See Tables 12.1 through 12.4 and Figures 12.1, 12.2 and 12.3.

Table 12.1

Region 10 Targets and Remedial Program Accomplishments Summary

Activity	Target	Total Acc.	Percent of Target
Pre-remedial			
PA Completions	201	58	28.0%
State	181	28	15.4%
EPA/FIT	20	30	150.0%
SSI Completions	60	71	118.3%
State	10	12	120.0%
EPA/FIT	50	59	118.0%
List Completions	4	0	0.0%
Remedial			
First RI/FS Starts	3	1	33.3%
Program	1	0	0.0%
Enforcement	1	0	0.0%
PRP	1	1	100.0%
Subsequent RI/FS Starts	1	0	0.0%
Program	0	0	
Enforcement	1	0	0.0%
PRP	0	0	
First RI/FS Completions	6	4	66.6%
Program	3	1	33.3%
Enforcement	0	0	
PRP	3	3	100.0%
Subsequent RI/FS Compl.	3	2	66.6%
Program	1	1	100.0%
Enforcement	0	0	
PRP	2	1	50.0%
First RD Starts	6	2	33.3%
Program	4	1	25.0%
Enforcement	1	1	100.0%
PRP	1	0	0.0%
Subsequent RD Starts	2	0	0.0%
Program	2	0	0.0%
Enforcement	0	0	
PRP	0	0	
First RD Completions	2	0	0.0%
Program	2	0	0.0%
Enforcement	0	0	
PRP	0	0	
Subsequent RD Completions	1	0	0.0%
Program	1	0	0.0%
Enforcement	0	0	
PRP	0	0	

***Table 12.1** (Continued)*

Region 10 Targets and Remedial Program Accomplishments Summary

Activity	Target	Total Acc.	Percent of Target
First RA Starts	1	0	0.0%
Program	1	0	0.0%
PRP	0	0	
Subsequent RA Starts	1	0	0.0%
Program	1	0	0.0%
PRP	0	0	
First RA Completions	2	0	0.0%
Program	2	0	0.0%
PRP	0	0	
Subsequent RA Completions	1	1	100.0%
Program	1	1	100.0%
PRP	0	0	
Final RA Completions	1	0	0.0%
Program	1	0	0.0%
PRP	0	0	
Expedited Response Action	2	1	50.0%
Program	2	0	0.0%
Enforcement	0	1	
PRP	0	0	
NPL Deletion Initiation	0	0	
Program	0	0	
Enforcement	0	0	

* ***Results represent a comparison of commitments versus accomplishments for fiscal year 1988 only.***

Table 12.2

Region 10 Targets and Removal Program Accomplishments Summary

Activity	Target	Total Acc.	Percent of Target
Removal			
First NPL Rmvl Start	5	1	20.0%
Program	3	0	0.0%
PRP	2	1	50.0%
Subsequent			
NPL Rmvl Start	1	0	0.0%
Program	1	0	0.0%
PRP	0	0	0.0%
First			
NPL Rmvl Completion	2	1	50.0%
Program	1	0	0.0%
PRP	1	1	100.0%
Subsequent			
NPL Rmvl Comp.	1	1	100.0%
Program	1	1	100.0%
PRP	0	0	0.0%
First Non-NPL Rmvl Start	5	1	220.0%
Program	3	3	100.0%
USCG	1	0	0.0%
PRP	1	8	800.0%
Subs. Non-NPL Rmvl Start	1	0	0.0%
Program	0	0	0.0%
USCG	0	0	0.0%
PRP	1	0	0.0%
First			
Non-NPL Rmvl Comp.	4	8	1200.0%
Program	3	3	100.0%
USCG	0	0	0.0%
PRP	1	5	500.0%
Subs.			
Non-NPL Rmvl Comp	0	0	0.0%
Program	0	0	0.0%
USCG	0	0	0.0%
PRP	0	0	0.0%

** Results represent a comparison of commitments versus accomplishments for fiscal year 1988 only.*

Table 12.3

Region 10 Targets and Enforcement Program Accomplishments Summary

Activity	Target	Total Acc.	Percent of Target
Enforcement			
NPL RP Searches Completions	0	2	
RD/RA Negotiations Completions	7	0	0.0%
Cost Recovery Cases Referred to HQ	2	1	50.0%
Admin Cost Recovery Settlements	2	0	0.0%
Section 106 Case Resolution/Trial	0	0	0.0%
Section 107 Case Resolution/Trial	2	1	50.0%
106 RD/RA Referrals Without Settlement	1	0	0.0%

** Results represent a comparison of commitments versus accomplishments for fiscal year 1988 only.*

Table 12.4

Site Specific Back-up to Targets and Accomplishments Report

RI/FS Starts	Financed
Harbor Island	Fund
Union Pacific Railroad	PRP

RODs

- Frontier Hard Chrome (2)
- Tacoma Tar Pits
- Gould
- Pacific Hide and Fur
- South Tacoma Landfill

RD Starts	Financed
Frontier Hard Chrome	Fund
Gould	Fund
Pacific Hide and Fur	Fund

RA Completions	Financed
Commencement Bay-South Tacoma Channel (Time Oil)	Fund

ERA Starts	Financed
Wyckoff	PRP

Table 12.4 (Continued)

Site Specific Back-up to Targets and Accomplishments Report

Orders Issued

- Non-NPL Removals
- Northwest Pipeline-Caldwell
- Northwest Pipeline-Mountain Home
- Northwest Pipeline-Pocatello
- Northwest Pipeline-Soda Springs
- Northwest Pipeline-Burley
- Dant & Russell-BN North Plains
- Northwest Pipeline-Baker
- Northwest Pipeline-Plymouth
- Bergsoe Metal Corp.

NPL Removals

- FMC Corp.-Yakima Pit
- Union Pacific Railroad (RI/FS)
- United Chrome Products (0&M)
- Queen City Farms (RI/FS)
- Wyckoff (ERA)

Removal Actions

Fund NPL

- Alaska Battery Enterprises

Fund Non-NPL

- New Meadows Fungicide
- Rangerfund II/Westfir
- Alaska Husky Battery

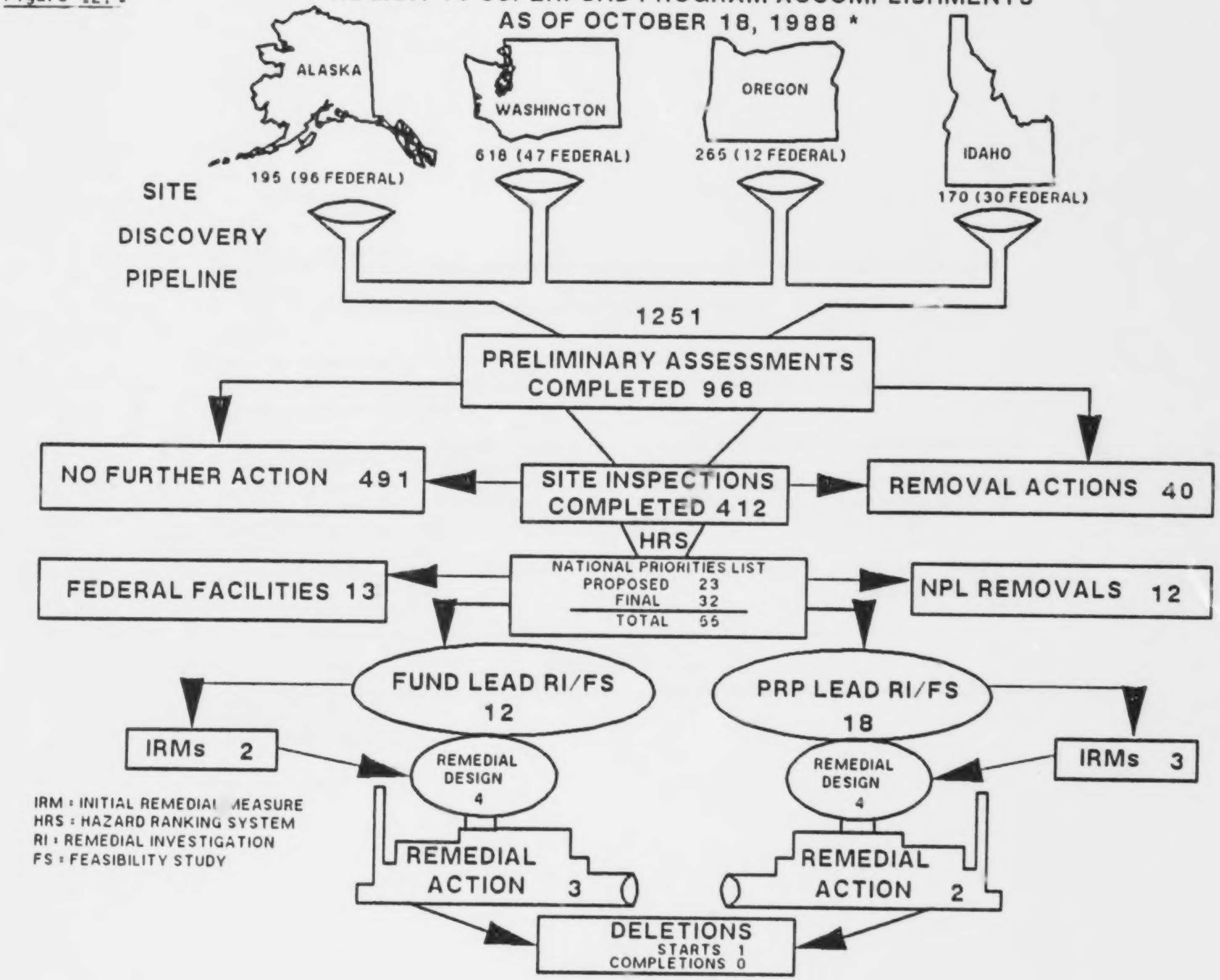
107 Cost Recovery Referrals

- Northwest Transformer

*** Results are for accomplishments achieved in fiscal year 1988 only.**

Figure 12.1

REGION 10 SUPERFUND PROGRAM ACCOMPLISHMENTS AS OF OCTOBER 18, 1988 *

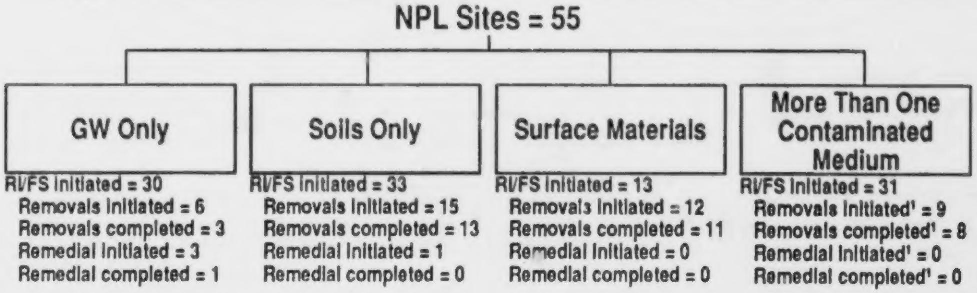


ALASKA
195 (96 FEDERAL)
WASHINGTON
618 (47 FEDERAL)
OREGON
265 (12 FEDERAL)
IDAHO
170 (30 FEDERAL)
SITE DISCOVERY PIPELINE
1251
PRELIMINARY ASSESSMENTS COMPLETED 968
NO FURTHER ACTION 491
SITE INSPECTIONS COMPLETED 412
REMOVAL ACTIONS 40
HRS
NATIONAL PRIORITIES LIST
PROPOSED 23
FINAL 32
TOTAL 55
FEDERAL FACILITIES 13
NPL REMOVALS 12
FUND LEAD RI/FS 12
PRP LEAD RI/FS 18
IRMs 2
IRMs 3
REMEDIAL DESIGN 4
REMEDIAL DESIGN 4
REMEDIAL ACTION 3
REMEDIAL ACTION 2
DELETIONS
STARTS 1
COMPLETIONS 0
IRM : INITIAL REMEDIAL MEASURE
HRS : HAZARD RANKING SYSTEM
RI : REMEDIAL INVESTIGATION
FS : FEASIBILITY STUDY

* Data of accomplishments are from inception of Superfund Program to date.

Figure 12.2

EPA



NPL Sites = 55

GW Only

RI/FS Initiated = 30
Removals initiated = 6
Removals completed = 3
Remedial initiated = 3
Remedial completed = 1

Soils Only

RI/FS Initiated = 33
Removals initiated = 15
Removals completed = 13
Remedial initiated = 1
Remedial completed = 0

Surface Materials

RI/FS Initiated = 13
Removals initiated = 12
Removals completed = 11
Remedial initiated = 0
Remedial completed = 0

More Than One Contaminated Medium

RI/FS Initiated = 31
Removals initiated[1] = 9
Removals completed[1] = 8
Remedial initiated[1] = 0
Remedial completed[1] = 0

Sites Not Yet Fully Characterized (uncertain as to which media is contaminated) = 3

Sites Yet To Be Investigated (sites where RI/FS not yet initiated but where a removal may have been initiated) = 21[2]

Sites Yet To Be Addressed (where neither a removal nor an RI/FS has been initiated) = 17[2]

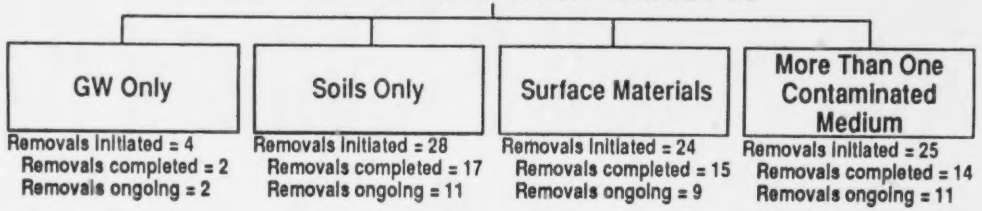
Sites Delisted = 1

1. Only sites that had removal or remedial actions focused on more than one contaminated medium were counted in this category.
2. Many of the sites that have not been addressed nor investigated include sites not yet final on the NPL, a large number of which are federal facilities.

Figure 12.3

EPA

Non-NPL Sites with Removal Actions = 28



GW Only

Removals initiated = 4
Removals completed = 2
Removals ongoing = 2

Soils Only

Removals initiated = 28
Removals completed = 17
Removals ongoing = 11

Surface Materials

Removals initiated = 24
Removals completed = 15
Removals ongoing = 9

More Than One Contaminated Medium

Removals initiated = 25
Removals completed = 14
Removals ongoing = 11

Number of sites where accumulation of surface materials represents or represented a public health or environmental exposure problem = 24

Number of sites with surface materials where remediation stabilized or eliminated threats of exposure to the public or the environment = 15

Number of sites where in-progress removal action will stabilize or eliminate threats of exposure to the public or the environment = 9

Slides courtesy of the Environmental Protection Agency Region 10 Graphics Section

Discussion

To date, the Superfund program has primarily relied on the SCAP/SPMS milestones to measure performance at NPL and non-NPL sites. Since the SCAP/SPMS systems primarily focus on measures of interest to management for purposes of resource distribution and monitoring of progress through the phases of an investigation and cleanup, the extent to which sites are environmentally improved is not well described through these measures. Therefore, we have chosen to enhance the SCAP/SPMS milestones ability to convey "environmental" and "public health" improvements by placing them in a context of groundwater, soils, and surface materials cleanup. However, even though much work has been done and considerable headway made in the Superfund program as evidenced by the number of projects in different phases of investigation and cleanup, one cannot determine from the measures presented in this report to what degree the environment and public health have been improved as a result of the Superfund effort.

Future Directions

Much substantive work to develop relevant environmental indicators that focus on problems generally found at Superfund sites has been done in Headquarters by the Office of Emergency and Remedial Response (OERR) and the Office of Management Systems and Evaluation (OMSE). The goal has been to develop environmental indicators that effectively describe the reduction in threats to public health and the environment as a result of cleanup efforts focused on hazardous substances at Superfund sites.

Eight environmental indicators have been identified as most promising in describing problems found at Superfund sites, and in providing a means of measuring progress in abating the problems through cleanup:

(1) Reduction in Concentrations of Environmental Contaminants

This indicator assesses progress in removing hazardous substances from exposure media by comparing contaminant concentrations measured before, during, and after site cleanup. It measures real progress in cleaning up sites and ultimately measures reduction in potential hazard at a site.

(2) Amount of Waste/Contaminated Material Treated or Removed

This group of indicators measures the total amount of contaminated material that is removed, treated, or contained at Superfund sites. These indicators give credit for the amount of activity and resources expended to reduce hazards. They do not, however, provide an explicit measure of hazard reduction. When reporting progress using this type of indicator, consideration should be given to concurrent reporting of indicators that measure reduction in contaminant concentrations (1) that compare contaminant concentrations to environmental or health standards (3) or that measure reduced ecotoxicity (5).

(3) Comparison of Residual Concentrations with Health Standards and Criteria

This indicator is similar to indicator (1). In addition, it provides a reference point for the measured concentration that provides some indication of the magnitude of the hazard. This indicator type is divided into standards for drinking water, drinking water criteria, and soil criteria.

(4) Comparison of Residual Concentrations with Ecological Criteria

These indicators compare site related contaminant concentrations in environmental media to ecologically-based criteria and report the number of sites meeting the appropriate criteria and the areal extent of the improvement. They are important indicators of progress at Superfund sites because they are among the few that address the biotic environment.

(5) Bioassays for Measures of Reduced Ecotoxicity

This group of indicators focuses on bioassays, which provide a measure of the potential for acute damage to biological organisms associated with hazardous substances. Because animals, plants, and people all are integral parts of the biosphere, reducing hazards to ecosytems and their biotic components will, in most cases, reduce hazards to people as well. Although useful, bioassays also are not perfect measures for assessing toxicity. No single organism is the most sensitive species to all toxic chemicals or mixtures of chemicals. Bioassays, therefore, should be viewed as a method that complements other methods for assessing ecological hazard at Superfund sites.

(6) Immediate Reduction in Exposure of Human Populations

This group of indicators measures the number of people provided relief from site-related hazards through Superfund program activities. The activities considered by these indicators include alternate supply of drinking water, significantly reduced access to on-site contaminants, and temporary and permanent relocation. Preventing public exposure is an important measure of progress in the program. However, this is seldom a stand-alone response; it usually complements cleanup. When reporting progress using this type of indicator, consideration should be given to coupling the indicator with other indicators or Superfund actions that describe progress toward cleanup.

(7) Reduction of Contaminant Residue Levels in Fish and Other Biota

There are several advantages to measuring contaminant concentrations in living organisms, as opposed to simply measuring concentrations in other environmental media. Living organisms function as continuous monitors by averaging fluctuations in exposure concentrations over space and time. They also increase the sensitivity of monitoring environmental conditions by concentrating certain types of materials in their tissues.

(8) Reduction of Exposure Pathways

This indicator is a measure of the number of routes of exposure to contaminated material that have been eliminated as a result of activities at Superfund sites. The exposure pathways include: ground water, surface water, soil (on-site), and air. This indicator most likely will be an aggregate of information contained in indicators (2) and (3).

Headquarters intends to implement some subset of these eight indicators in FY 90. The final decision as to which indicators will be implemented will be made in the spring of FY 89. It is also hoped that one or two of these indicators, perhaps amount of Waste/Contaminated Material Treated or Removed and/or Immediate Reduction in Exposure of Human Populations, could be implemented some time in FY 89.

Region 10 is enthusiastic about the Headquarters effort and is following it closely.

Superfund Environmental Indicators FY 89 and Beyond

The Superfund program will report accomplishments within the context of the contaminated media found at both NPL sites and non-NPL sites. Hence, progress will be tracked with respect to groundwater, soils and surface materials investigations and cleanups as depicted in Figures 12.2 and 12.3.

Additionally, if any of the "new" environmental indicators proposed by Headquarters for implementation in FY 90 are ready for implementation in late FY 89, we will attempt to use them as well to report progress. In FY 90 we plan to use those "new" indicators as implemented. We will also continue to track milestone accomplishments as required by the Strategic Planning and Management System (SPMS).

Groundwater Cleanup

1. **Number of sites with contaminated aquifer where RI/FS has been initiated**
2. **Number of sites with contaminated aquifer where removal action has been started**
3. **Number of sites with contaminated aquifer where removal action has been completed**
4. **Number of sites with contaminated aquifer where remedial action has been started**
5. **Number of sites with contaminated aquifer where remedial action has been completed**

Soils Cleanup

1. **Number of sites with contaminated soil where RI/FS has been initiated**
2. **Number of sites with contaminated soil where removal action has been started**
3. **Number of sites with contaminated soil where removal action has been completed**
4. **Number of sites with contaminated soil where remedial action has been started**
5. **Number of sites with contaminated soil where remedial action has been completed**

Surface Material

1. **Number of sites with contaminated surface materials (i.e. drums, scrap metal, dilapidated buildings) where RI/FS has been initiated**
2. **Number of sites with contaminated surface material where removal action has been started**
3. **Number of sites with contaminated surface materials where removal action has been completed**
4. **Number of sites with contaminated surface materials where remedial action has been started**
5. **Number of sites with contaminated surface materials where remedial action has been completed**

Progress using the above categories will be reported at NPL sites, while at non-NPL sites, the following indicators will also be used to measure progress:

1. **Number of sites where surface materials represent a public health or environmental exposure problem**
2. **Number of sites where removal actions stabilized or eliminated threats of exposure to the public or to the environment.**

Whenever possible, site managers at NPL sites will photographically record conditions prior to cleanup, during cleanup, and post cleanup so as to have a visual record of the problems addressed at these sites.